FINAL

WORK PLAN
FOR CERCLA FIVE-YEAR REVIEW

MONSANTO ELEMENTAL PHOSPHORUS PLANT
SODA SPRINGS, IDAHO

Prepared by

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Revision -0-, October 2002

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ACRONYMS

AOC	Administrative Order on Consent
COC	Contaminant of Concern
COPC	Constituent of Potential Concern
DQOs	Data Quality Objectives
EPA	Environmental Protection Agency
FSP	Field Sampling Plan
HSP	Health and Safety Plan
IDEQ	Idaho Department of Environmental Quality
MNA	Monitored Natural Attenuation
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
PARCC	Precision, accuracy, representativeness, completeness, and comparability
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAOs	Remedial Action Objectives
RI/FS	Remedial Investigation/Feasibility Study
RI	Remedial Investigation
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure

1. INTRODUCTION

1.1 OVERVIEW

In August of 1990, the United States Environmental Protection Agency (EPA) placed the Monsanto Company (Monsanto) elemental phosphorus plant in Soda Springs, Idaho, on the National Priorities List (NPL), which is contained within Appendix B of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, 40 CFR 300). The EPA took this action pursuant to their authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, 42 USC 9601 et seq.).[1] Figure 1.1-1 shows a map of the area in question. Figure 1.1-2 shows a map of the immediate vicinity.

An Adminstrative Order on Consent (AOC) was issued by EPA Region 10 (EPA-10) and agreed to by Monsanto on March 19, 1991 for the performance and preparation of a remedial investigation and feasibility study (RI/FS) for the Soda Springs plant (Plant). A Remedial Investigation (RI) was performed for groundwater, soil, source piles, surface water, air, biota, and sediments. No further action was required for source materials, air, biota, surface water, or Soda Creek sediments. Constituents of potential concern (COPCs) were identified for groundwater and soil based on exceedances of EPA risk screening criteria. This Work Plan, however, excludes groundwater so no further background information will be provided for groundwater.[2] The Record of Decision (ROD) was signed on April 30, 1997, identifying the contaminants of concern (COCs) for source piles and contaminated soils outside the Plant boundaries as radionuclides[3] (radium-226 (^{226}Ra)), arsenic and beryllium. Figure 1.1-3 shows the concentrations of COCs in off-site soils. The Remedial Action Objectives (RAOs) for soil are summarized as follows:

- Prevent external exposure to radionuclides in soils at levels that pose cumulative conservatively estimated incremental lifetime cancer risks above $3x10^{-4}$ (3.7 pCi/g)
- In areas where radionuclides exceed cleanup goals, metals have the following RAO:
  - Metals exceeding background and posing an excess carcinogenic risk above $1x10^{-5}$, or a non-cancer risk with a hazard quotient of 1 or more.
- Controls for source piles must remain in place and off-Plant soil concentrations must not increase.

The selected remedy for source piles within the Plant is a program of five-year reviews to ensure that the remedy remains protective, since hazardous substances remain on-site above levels that

[1] All regulatory and statutory citations within this work plan refer to the version of the regulation or statute in effect, as amended, on the date of work plan publication.
[2] Groundwater monitoring is conducted on an annual basis by Golder Associates.
[3] Radionuclides, as the term is used by the ROD, means only radium-226 (^{226}Ra).

allow for unrestricted use. The selected remedy for contaminated soils surrounding the plant is institutional controls in the form of land use restrictions placed in deeds. Although no further action is required for sediments and no remedy was selected, there is a requirement to collect sediment samples to support the five year review assessment of whether contaminant concentrations are remaining stable or declining as predicted.

This is the first five-year review subsequent to the issue of the ROD in 1997. Monsanto has authorized MWH to prepare this Work Plan to fulfill the requirements of the CERCLA five-year review. Figure 1.1-4 shows the Contractor organization for the CERCLA five-year review.

1.2 PURPOSE AND SCOPE OF THE WORK PLAN

The purpose of this Work Plan is to describe the tasks, schedule, and Contractor organization for the CERCLA five-year review.

The scope of this Work Plan is determined by the ROD and contains four primary tasks.

- **Task 1 - Sediments Sampling: The** ROD specifies the collection of sediment samples to support the assessment of contaminant concentrations.

- **Task 2 - Soil sampling:** The ROD specifies that soil sampling be done from the current fence line out to the Phase II soil sampling locations in order to determine the concentrations of COCs in soils, and verify that source control is effectively preventing further spread of site contaminants and/or recontamination of soils.

- **Task 3 - Plant Source Pile Controls:** The ROD requires a review of plant compliance status, worker health and safety programs and dust control efforts. There is no current or planned closure for the plant, so no review of closure procedures is required. This Work Plan summarizes the results of the health, safety and environment compliance audit program and contains a site review for dust control efforts.

- **Task 4 - Institutional Controls:** The ROD requires a review of land use and Institutional Controls for all soil grids surrounding the plant which contain ^{226}Ra concentrations greater than the remediation goal of 3.7 pCi/g based on a statistically valid sampling program. This Work Plan contains an assessment of the current status of all Institutional Controls, and the data collected from sampling will be used to re-evaluate the status of the ^{226}Ra concentrations.

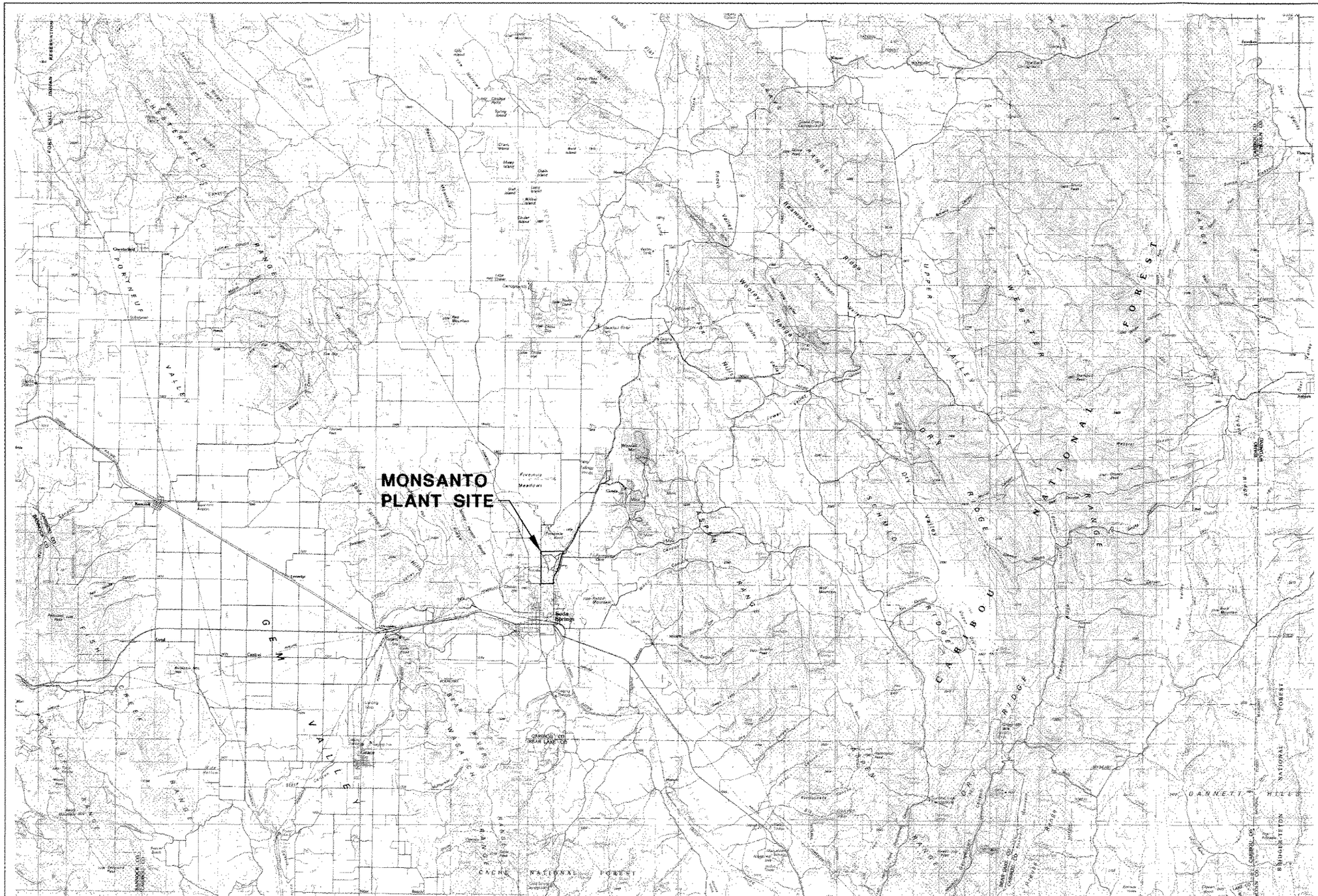
1.3 Organization of the Work Plan

This Work Plan references the *Remedial Investigation/Feasibility Study Phase I Work Plan* (Golder Associates, 1991) and the *Phase II Remedial Investigation Work Plan* (Golder Associates, 1992). It has been updated to specify the requirements of the CERCLA five-year

review. These changes to the Work Plan are implemented following review and approval by EPA-10, the regulatory agency overseeing the monitoring activities at the Plant.

This Work Plan includes five chapters. Chapter 2 summarizes site characterization data, Chapter 3 provides the rationale and data quality objectives for the five-year review activities, Chapter 4 outlines the tasks and the project schedule, and Chapter 5 provides references.

The companion document to this Work Plan is the *Sampling and Analysis Plan for 2002 CERCLA Five Year Review Soil and Sediment Sampling* (SAP) which contains the Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP), and Health and Safety Plan (HSP). The FSP contains a summary of site background, sampling objectives, sample location and frequency, sample designation, sampling equipment and procedures, and sample handling and analysis.



N

METERS
0 6,000 12,000
0 20,000 40,000
FEET

NOTE:
Plant and property boundaries are approximate.

USGS Topographic Map Soda Springs
Idaho–Wyoming 1:100,000 (1982)

FIGURE **1.1-1**
MONSANTO PLANT AREA MAP
MONSANTO/CERCLA FIVE YEAR REVIEW

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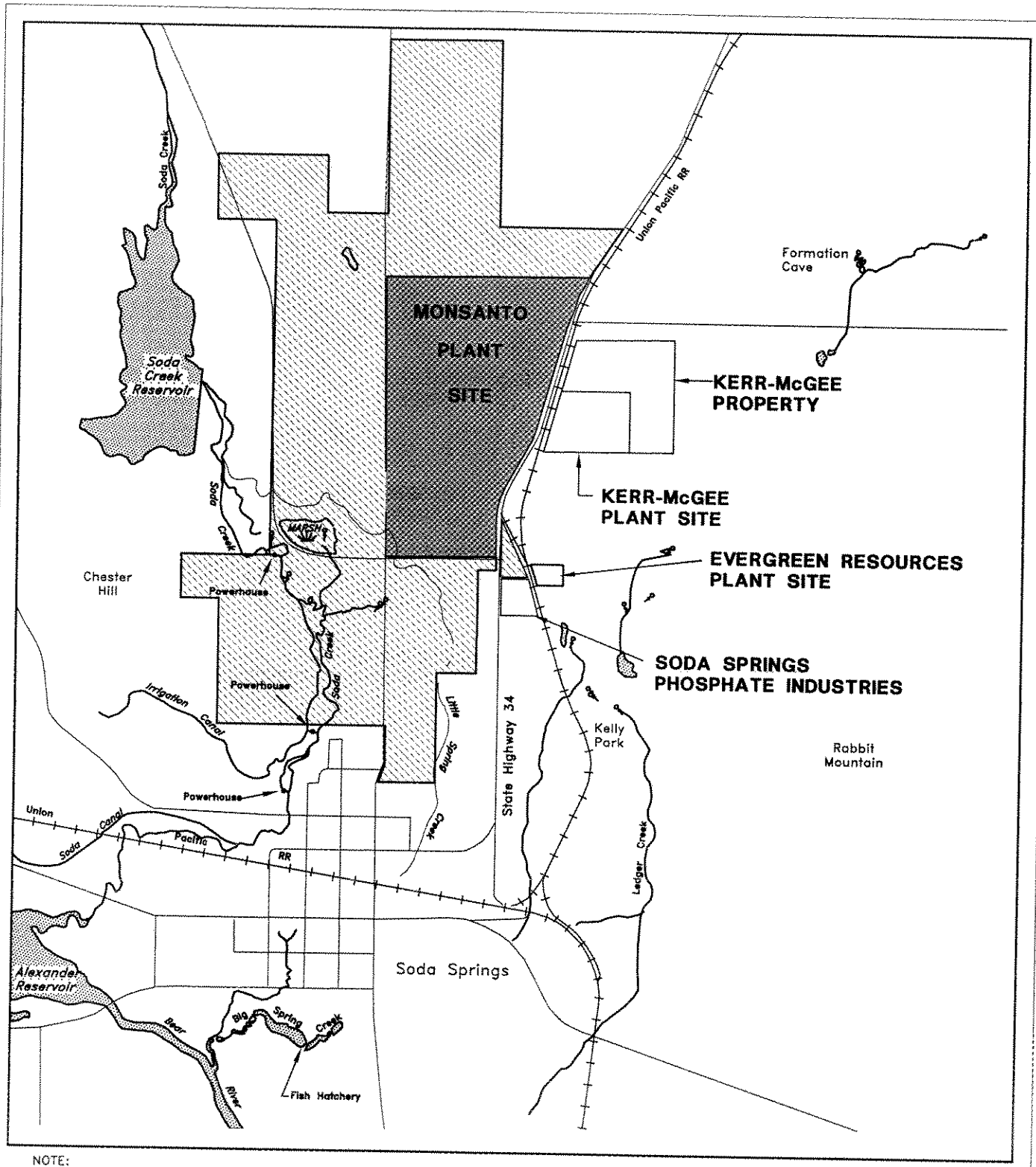
MWH



NOTE:
Plant and property boundaries are approximate.

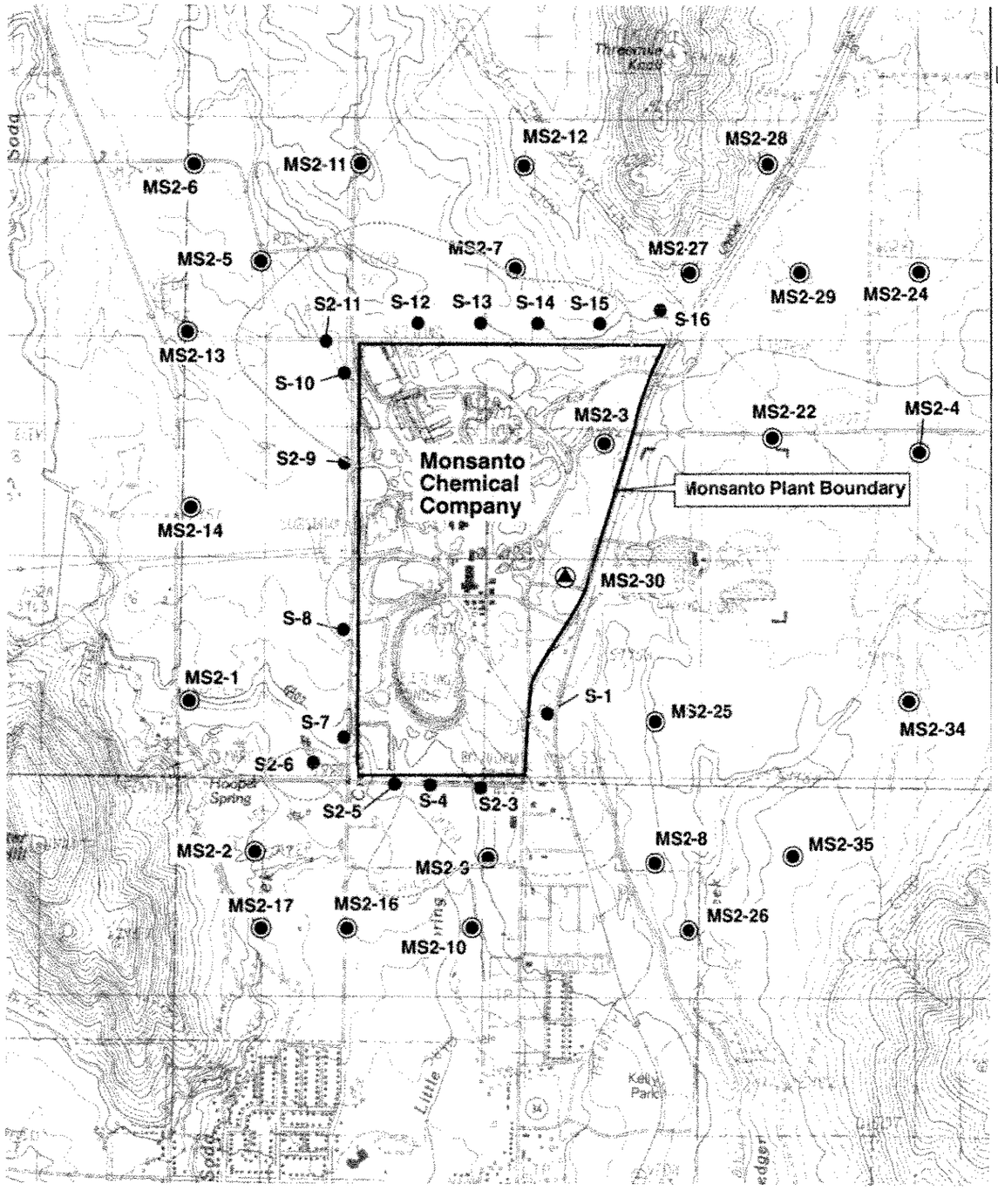
SOURCE:
MONSANTO/PHASE II RI REPORT (GOLDER 1995)

LEGEND:

MONSANTO PLANT SITE

PROPERTY OWNED OR EASMENT PURCHASED BY MONSANTO

FIGURE 1.1-2
MONSANTO PLANT VICINITY MAP
MONSANTO/CERCLA FIVE YEAR REVIEW



LEGEND:

- S-XX —— SOIL SAMPLING LOCATION FROM PHASE I
- MS2-XX — SOIL SAMPLING LOCATION FROM PHASE II

Soil

Area where Radium-226 concentrations exceed the $3x10^{-4}$ target cleanup level of 3.7 pCi/g

Area boundary is inferred due to inadequate bounding data or uncertainty of constituent(s) source(s)

The areas shown are based on analytical data from soil samples collected from the 0–1" depth interval.

N

METERS
0 100 250 500
0 2000 4000
FEET

SOURCE:
MONSANTO FEASIBILITY STUDY (MWH, 1996)

USGS Topographic Map Soda Springs
Idaho–Wyoming 1:100,000 (1982)

FIGURE **1.1-3**
CONSTITUENT OF CONCERN IN OFF-SITE SOILS
MONSANTO/CERCLA FIVE YEAR REVIEW

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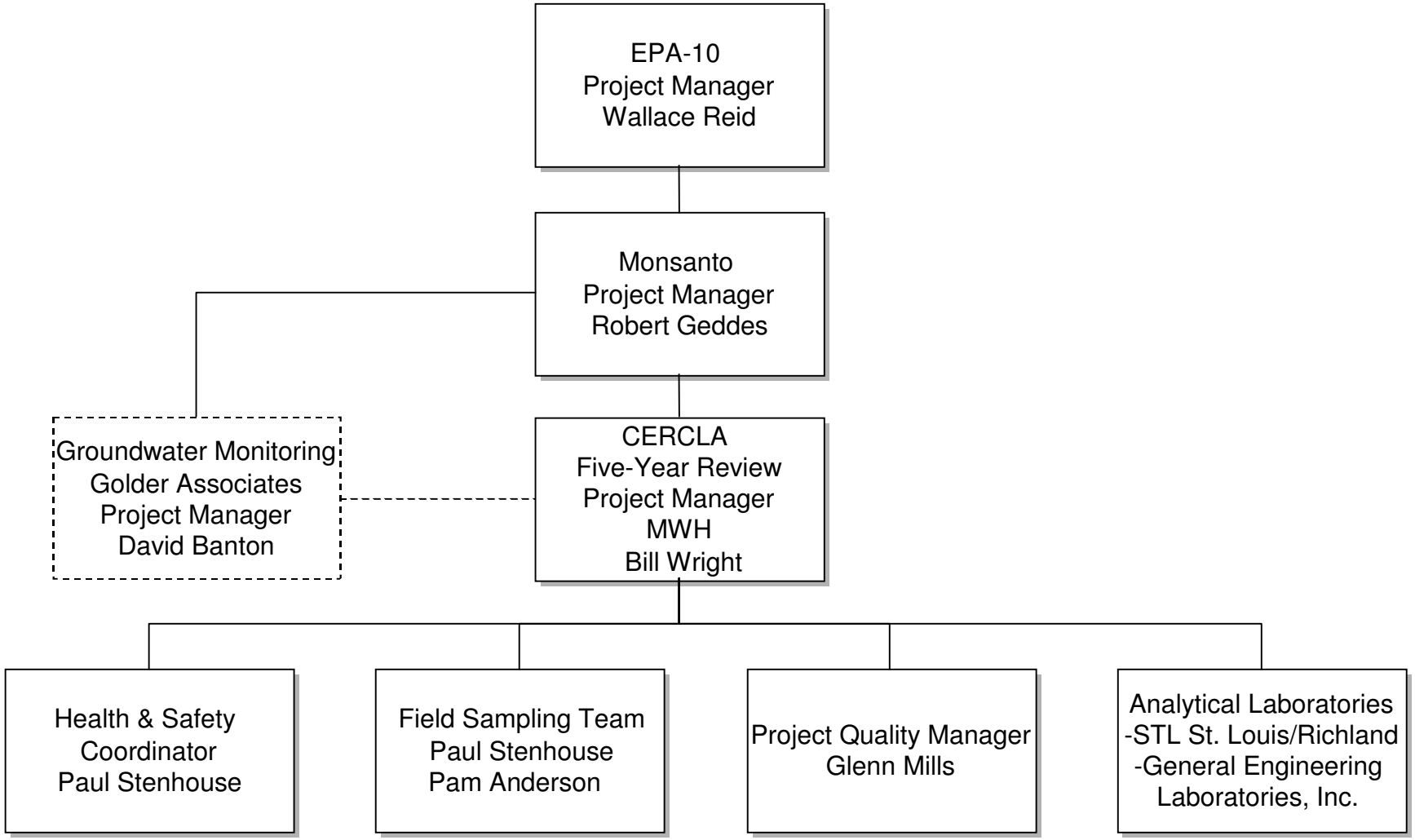


Figure 1.1-4: Contractor Organization

2. BACKGROUND

A preliminary discussion of the background and general description of the site is presented below. More detailed information can be obtained in the *Phase II Remedial Action Work Plan* (Golder Associates, 1992) and accompanying *Phase II Remedial Investigation Report for the Monsanto Soda Springs Plant* (Golder Associates, 1995).

2.1 Description of Site and Vicinity

The Monsanto Chemical Company site is located in Caribou County, Idaho approximately one mile north of the City of Soda Springs. The Plant occupies approximately 540 acres, while the entire site includes around 800 acres. The closest surface water body is Soda Creek, 2,000 feet west of the Plant.

The population of Soda Springs is 3,000, and most of the residents' water is supplied from one of two City sources; Formation Springs to the northeast of the City and the Plant, or Ledge Creek Springs to the southeast. Both city springs are in different hydrogeological systems from, and are unaffected by, the Site. Twenty-two domestic water supply wells and seven irrigation wells are registered within 3 miles of the Site. The only domestic well known to have been affected by the Monsanto site (the Harris well) was removed from service in 1984. Five other major industrial facilities are located within four miles of the Site.

Monsanto purchased the Site in 1952 and built the Plant to process locally mined phosphate ore into elemental phosphorus. In 1984, Golder Associates was commissioned to evaluate groundwater and surface water impacts resulting from current and past activity. This investigation showed groundwater under the Site to contain elevated levels of fluoride, cadmium, selenium, and vanadium. The sources of these constituents were hypothesized to be the old underflow solids pond, the northwest pond, and the former hydroclarifier. A separate plume containing chloride, sulfate and vanadium originating east of the Monsanto site and extending onto the southeast portion of the Site was also found. This plume is attributable to the Kerr-McGee Chemical Corporation, located across Highway 34 from the Monsanto Plant. In 1987, during groundwater sampling by Ecology and Environment, an EPA contractor found elevated levels of fluoride, cadmium, selenium, and sulfate in monitoring and production wells. The Site was added to the NPL on August 30, 1990.

2.1.1 Remedial Investigation/Feasibility Study

Between March 1991 and November 1995, a RI was performed for groundwater, soil, source materials, surface water and air, biota, and sediments. COPCs were identified where the risk screening criteria for residential use were exceeded. The RI was conducted in two Phases, and the findings are reported in full in the Phase II RI report (Golder, 1995).

Risk at the site is defined by human exposure to external gamma radiation associated with ^{226}Ra

in materials by-products within the plant and surface soil outside the plant fence line. No other constituents were found to pose an unacceptable risk to human health. While there are several constituents present in groundwater beneath the plant that exceed RAOs there is no human exposure to the affected groundwater. Ecological risks in aquatic and terrestrial habitats near the plant were determined to be insignificant.

The baseline risk assessment deterministically estimated an incremental lifetime cancer rate of 5×10^{-4} for the most-exposed subpopulation of workers on site—heavy equipment operators hauling molten slag on the slag pile. A semi-probabilistic version of the baseline risk assessment (an assessment that ignores uncertainty in the carcinogenic slope factor) estimated the 95th percentile of the risk estimate for a randomly selected member of this subpopulation to be 8×10^{-5} (5×10^{-4} was shown to be a 99.9th-percentile estimate).

There is currently no unacceptable risk to residents near the site, but an incremental lifetime cancer rate of 2×10^{-3} was unrealistically predicted for someone who might build a home adjacent to the northern fence line of the plant, where the highest concentrations of ^{226}Ra were observed. The 95th percentile of the semi-probabilistic version of the assessment for a randomly selected individual who would build such a home was $2x10^{-8}$ (2×10^{-3} was shown to be a bounding estimate, far beyond the 99.999th percentile). The RAO for soil was 3.7 pCi/g, based on a statistically valid sampling program. Figure 2.1-1 shows the Phase I and Phase II soil sample locations. No COCs were identified for sediments. Figure 2.1-2 shows the locations of the Phase I and II Soda Creek sediment sampling locations. Figures 2.1-3, 2.1-4 and 2.1-5 show the locations of the supplemental sediment sampling conducted in 1994 in Soda Creek and Alexander Reservoir.

On April 30, 1997 the ROD was released. The selected remedy for soils not on the Site allowed for either Institutional Controls, or excavation and disposal of soils, as options for affected agricultural and residential landowners. The selected remedy for groundwater was monitored natural attenuation with institutional controls. Monsanto implemented a land/easement acquisition program that ensured landowners a fair value for their property and proper documentation with local authorities (with additional notification to EPA) of the institutional controls arising from such acquisitions.

2.2 Physical Site Characteristics:

2.2.1 Surface Hydrology

The major river in the vicinity of the Monsanto Plant is the Bear River, located approximately two miles to the south and southwest of the Monsanto Plant. Regional man-made surface waters include Alexander Reservoir and Blackfoot Reservoir. Natural local surface-water features in the Monsanto Plant vicinity include Soda Creek, Ledger Creek, Big Spring Creek, two wetland areas, and numerous springs and spring-fed ponds. Local man-made surface water features include the ponds on the Plant site and Soda Creek Reservoir. Monsanto discharges their non-contact

cooling water under a National Pollutant Discharge Elimination System (NPDES) permit, via subsurface pipeline into Soda Creek.

2.2.2 Geology

Regionally, the Monsanto Plant is located near the southern end of the Blackfoot Lava Field which has filled in a generally north-northwest trending valley bordered by the Chesterfield Range and the Soda Hills on the west, and by the Aspen Range on the east. The Plant is located within the Bear River graben. A series of north-northwest trending normal faults extend from the southeast of the Plant northward to the Blackfoot Reservoir. The Plant is underlain at greater depth by an extension of the Paris Thrust fault.

Locally, the Plant property is underlain by a thin veneer of alluvial soils which overlie basalt flows of the Blackfoot Lava Field. Five basalt flows, separated by sedimentary interbeds or weathered basalt zones, are present beneath the Plant. The basalt flows vary in thickness from less than 10 feet to 80 feet. The sedimentary units and weathered basalt zones range from 1 to 23 feet thick. The basalt flows overlie the Salt Lake Formation.

Northwest trending, en-echelon normal faults (both west and east side down relative displacement) are present in the Plant area and commonly form narrow grabens that are 1,000 to 1,500 feet wide and up to 2.5 to 3 miles long. Normal fault displacement has oftentimes offset permeable cinder zones and weathered basalt horizons against less permeable unweathered basalt flow interiors which may interrupt lateral groundwater flow and create springs. A prominent fault scarp enters the Plant near the northwest corner and appears to die out just west of the southeast corner of the Plant. A subsidiary fault parallels this fault approximately 1,500 feet to the southwest.

Several normal faults exist east of the Plant. The Finch Spring fault, a prominent fault scarp that trends approximately north-south and has measured minimum vertical displacement of 20 to 70 feet (west-side down). A subparallel fault forms a small graben at the north end of the Finch Spring fault and adjacent and subparallel to the southern part of the Finch Spring fault is the Ledger Creek Springs graben. The Ledger Creek Spring graben is bordered by prominent fault scarps that have an estimated 40 to 60 feet of vertical separation. The west-side-down displacement of the Finch Spring fault and the east-side-down of the western fault of the Ledger Creek Springs graben may act as hydraulic barriers such that groundwater west of the Finch Spring fault may not flow into the Ledger Creek Springs area.

2.2.3 Pedology

The five soil types around the Monsanto Plant are similar in morphology and are primarily classified mollisols. The soils are largely dominated by the characteristics of the loess parent material from which they are derived and have similar particle sizes; the dominant particle-size class is silt-sized which is consistent with a loess parent material. The soils are classified as clayey silt with some sand and a trace of gravel. There is no appreciable difference in soil types

between samples collected from the 0-1 inch depth interval and those collected from the 0-6 inch depth interval. The control soils are classified as clayey silt with some sand and with no appreciable difference between the two depth intervals. Soils within the Plant are disturbed and cannot be correlated with the surrounding soils.

2.2.4 Land Use

The City of Soda Springs is located approximately one mile south of the Monsanto Plant with a population of about 3,000. Land use within the city limits is mostly residential with some commercial, agriculture, and light industrial zones. A light and heavy industrial zone extends from the north end of the city along Route 34 to towards the Monsanto Plant.

The Monsanto Plant is located outside of the city limits. The workforce population is approximately 400. The land use within the boundaries of the Plant is industrial. The Monsanto property includes agricultural land to the south and southwest of the industrial facility, and is surrounded by open agricultural and range lands.

2.3 Nature and Extent of Constituent Releases

The total nature and extent of potential constituent releases is detailed in the Phase II RI Report (Golder, 1995). This Work Plan is limited to a description of source piles, consisting of material and by-product stockpiles. Figure 2.3-1 shows the locations of the following material and by-product stockpiles: [4]

- Phosphate ore, coke and quartzite stockpiles: Phosphate ore, coke, and quartzite are the primary materials used in the production of elemental phosphorus. The phosphate ore is stockpiled in the northeast portion of the Plant in two piles covering an area of approximately 1,200 feet by 600 feet about 40 feet high with a mass of approximately 500,000 tons. The coke and quartzites stockpiles are located in the eastern portion of the Plant, south of the phosphate ore stockpiles, and contain approximately 22,000 tons of coke and 150,000 tons of quartzite.

- Nodule fines piles: The nodule fines resulting from the nodulizing of the phosphate ore in the kiln are stockpiled in the northeast corner of the Plant, just south of the phosphate ore stockpiles. These materials are recycled in the kiln with the phosphate ore during the beneficiation process.

- Calcium silicate slag piles: The slag consists primarily of calcium silicate and constitutes the greatest quantity of waste material at the Plant. This slag is pored as a molten material and cools as a solid mass. An estimated 23 million tons of slag are stockpiled at the Plant.

[4]Figure 2.3-1 shows the footprints as they were in 1992. All measurements of size contained in Section 2.3 are based on information gathered during the RI and may not be current. This Work Plan contains a task for updating this information.

- Ferrophosphorus slag: A by-product generated in the furnace as a result of the naturally occurring iron and other metals in the ore. It is transported as it is produced to Kerr-McGee for use in their vanadium extraction process.

- Baghouse dust: Dust collected by the many air pollution control units associated with the Plant, primarily made up of small size fractions of phosphate ore, nodules, coke, and quartzite. It is stockpiled in the northeast portion of the Plant.

- Underflow solids: Fine-grained particulate matter is removed from rotary-kiln exhaust gas by a spray-tower scrubber followed by high-energy venturi scrubbers. The resulting wet slurry is settled and dewatered in the hydroclarifier, resulting in underflow solids. The underflow solids are recycled in the process to recover their phosphate ore value. Underflow solids are stockpiled in the northeast portion of the Plant prior to recycling.

- Treater dust: Treater dust is a fine-grained precipitate that is generated as the phosphorus is condensed to a liquid. This dust is placed in a chamber for oxidation of any residual phosphorus; it consists of coarse-to-fine sand and silt.

Dispersion modeling analysis showed that the primary material and by-product stockpiles that individually may contribute $\geq$10% to the total annual average deposition rates of trace contaminants are wind erosion of the underflow solids stockpile, ore stockpile, treater dust stockpile, and slag stockpile.

2.4 Sediment Quality

Soda Creek is the only natural stream nearby and potentially affected by the Site. During Phase I and II, sediments in Soda Creek were sampled and analyzed along with Plant effluent. Statistical analyses were performed on the water and sediment data to determine which downstream parameters are elevated with respect to upstream concentrations. Each elevated constituent was subjected to a preliminary risk-based screening to determine which were COPCs.

Sediments collected from Soda Creek downstream of the effluent outfall were found to contain elevated levels of As, Cd, Cu, Ni, Se, Ag, V, and ^{210}Po. As a result the ecological risk assessment initially concluded that action might be warranted, and a decision was made to do an additional sediment investigation, including toxicity testing. Subsequently, additional samples were collected from Soda Creek and Alexander Reservoir, and toxicity testing was conducted on sediments collected upstream and downstream of the effluent outfall using benthic invertebrates. The control samples collected upstream of the effluent outfall possessed an inherent toxicity relative to the laboratory controls, apparently due to the naturally occurring sodic content. Sediment samples collected downstream of the effluent outfall showed a greater toxicity than upstream controls. Ultimately, however, no statistically significant increase in toxicity was ever observed.

2.5 Soil Quality

During the Phase I RI, surface and subsurface samples were collected from soils surrounding the Monsanto Plant and from unaffected control points located approximately 13 miles southwest of the Plant. Samples were taken from two depth intervals: 0-1 inch (A group) and 0-6 inch (B group). Statistical analyses were performed on the soil data for each soil group to determine which parameters were elevated with respect to control concentrations. The results of the Phase I soil sampling were used to design the Phase II sampling and analysis. The Phase II soil samples defined the areal extent of elevated constituents in off-site soils, and were taken from 0-1, 0-6 and 6-12 inch depth intervals.

At the conclusion of the Phase II sampling, EPA-10 used the results of the 0-1 inch depth interval as the most likely zone of human exposure for risk assessment purposes. The current characterization of the soil quality includes the following contaminants elevated above background: Al, As, Be, Cd, Cr, Mn, Ag, V, Zn, ^{210}Pb, ^{210}Po, ^{226}Ra, ^{230}Th, ^{238}U. Of these contaminants, the following exceeded risk-screening criteria for residential use and were considered COPCs: As, Be, Cd, V, ^{210}Pb, ^{210}Po, ^{226}Ra, ^{230}Th, ^{238}U. The radionuclides were concentrated in the surficial layer of soil (0-1 inch). Although not every constituent shows the same spatial pattern, many of the COPCs are clustered around the north and south ends of the Plant. The ROD determines that, of the COPCs present in elevated concentrations, only As, Be and ^{226}Ra are COCs. Of the COCs, metals are only a concern in areas where ^{226}Ra is also present in elevated concentrations.

No metals exceed a hazard quotient of one, and only As and Be can be shown, using overly conservative deterministic calculations, to exceed an incremental lifetime cancer rate of $1x10^{-5}$, and the exceedances are minimal. In fact, in the few locations sampled during the RI in which such exceedances occurred, the risks were dwarfed by those associated with ^{226}Ra; in fact, they were numerically insignificant relative to the ^{226}Ra risks. Thus, the ROD ends up focusing solely on ^{226}Ra for purposes of soil quality monitoring; as such, so does this plan.

2.6 Constituent Exposure Routes

The identified pathways for constituent exposure for soil are the ingestion of the COPCs in the soils through agricultural use or in livestock that feed on vegetation from the soils adjacent to the Plant.

The Phase II Work Plan contains detailed information on the conceptual exposure pathway model used to derive this summary information. Controls of the material and by-product stockpiles have been put in place in order to minimize further exposure. Approximately twenty acres of inactive stockpile areas are covered with dust suppressant on an annual basis. Magnesium chloride is applied plant dirt roads approximately twice in the early and mid-to-late summer as necessary. A water truck is used for daily road dust suppression.

2.7 Land Use Assessment and Institutional Controls

All of the residential property owners have elected institutional controls over the option of soil excavation and disposal. Monsanto has purchased either the property or an environmental easement of all adjacent agricultural lands with elevated concentrations, ensuring that they control the beneficial use of the properties. Figure 2.7-1, shows the present day boundaries of the properties and easements acquired by Monsanto.[5]

2.8 Audit Program

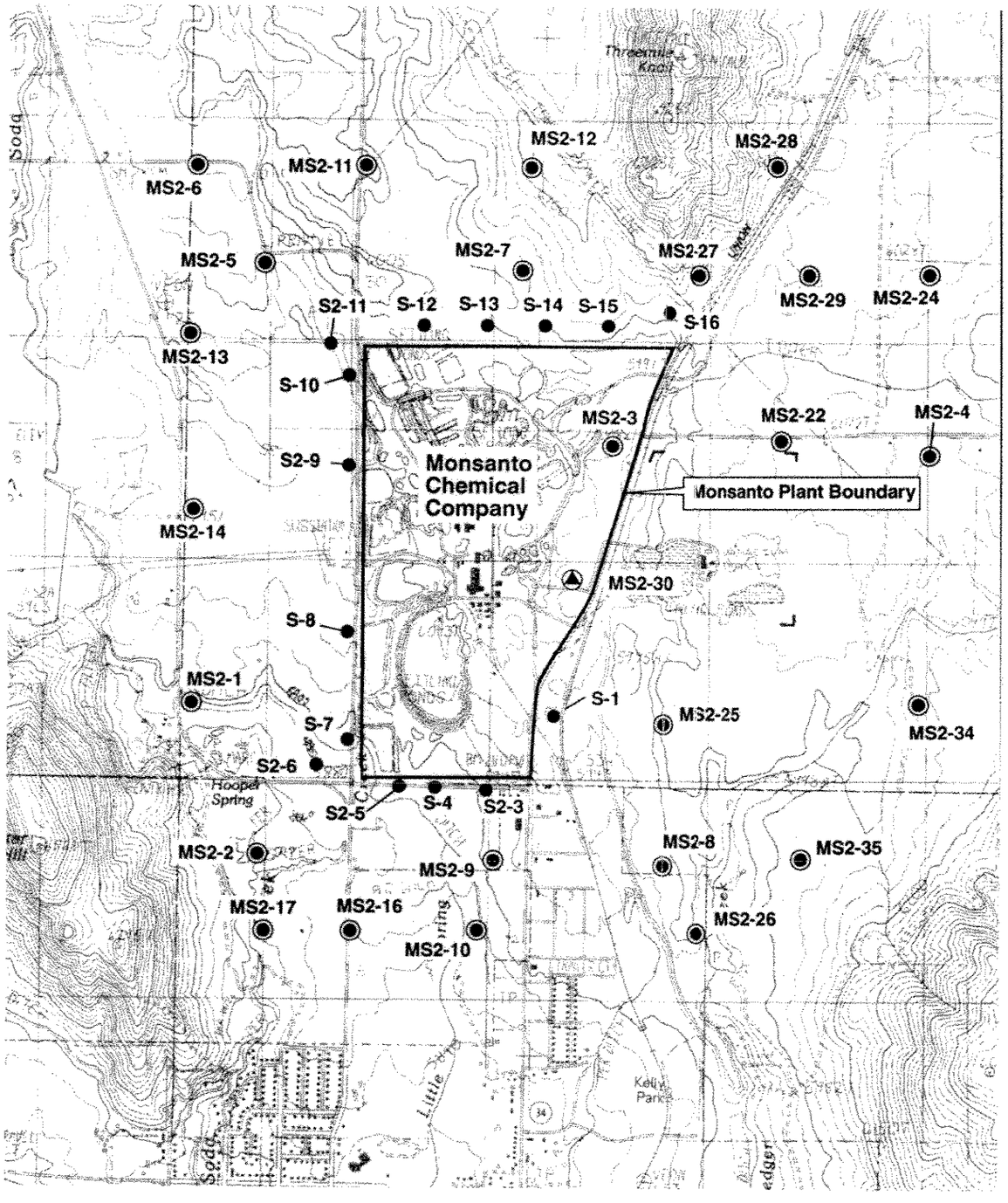
The Monsanto Plant received Occupational Safety and Health Administration (OSHA) Voluntary Protection Program (VPP) Star status in 1994 and continues to maintain the certification. The most recent re-certification audit was conducted in August of 1998.

Monsanto has a corporate environmental audit program whereby, every three years, 3-5 company employees spend a week conducting an on-site audit resulting in both findings and recommendations for improvement. The last corporate audit was conducted in May of 2000. There were no major findings of noncompliance.

The EPA conducted a National Pollutant Discharge Elimination System (NPDES) audit in September of 2002, and no findings or areas of concern were reported. The most recent EPA RCRA audit was conducted in December of 2001. The only issues concerned the elemental phosphorus industry at large, and were not specific to Monsanto's operations. The EPA also conducted a TRI/SARA 313 audit in August of 1998. It was found that Monsanto had neglected to submit Form Rs on two occasions, and this issue was remedied.

In addition, the Idaho Department of Environmental Quality (IDEQ) conducts an annual air inspection. No notices of violation or findings of non-compliance have been received.

[5] Figure 2.7-1 shows an affected area in the Northwest corner as not yet acquired. This property has been acquired since the figure was generated, but the new property boundaries were not available at the time of production of the Draft Work Plan. This figure will be updated in the Final Work Plan.



LEGEND:

- ● S-XX —— SOIL SAMPLING LOCATION FROM PHASE I
- ◉ MS2-XX — SOIL SAMPLING LOCATION FROM PHASE II
- ▲ MS2-XX — SOIL DEPTH PROFILE AND WATER SAMPLE

N

METERS
0 100 250 500
0 2000 4000
FEET

SOURCE:
PHASE II RI REPORT (GOLDER, 1995)

USGS Topographic Map Soda Springs
Idaho-Wyoming 1:100,000 (1982)

FIGURE 2.1-1
PHASE I AND II SOIL SAMPLE LOCATIONS
MONSANTO/CERCLA FIVE YEAR REVIEW

MWH

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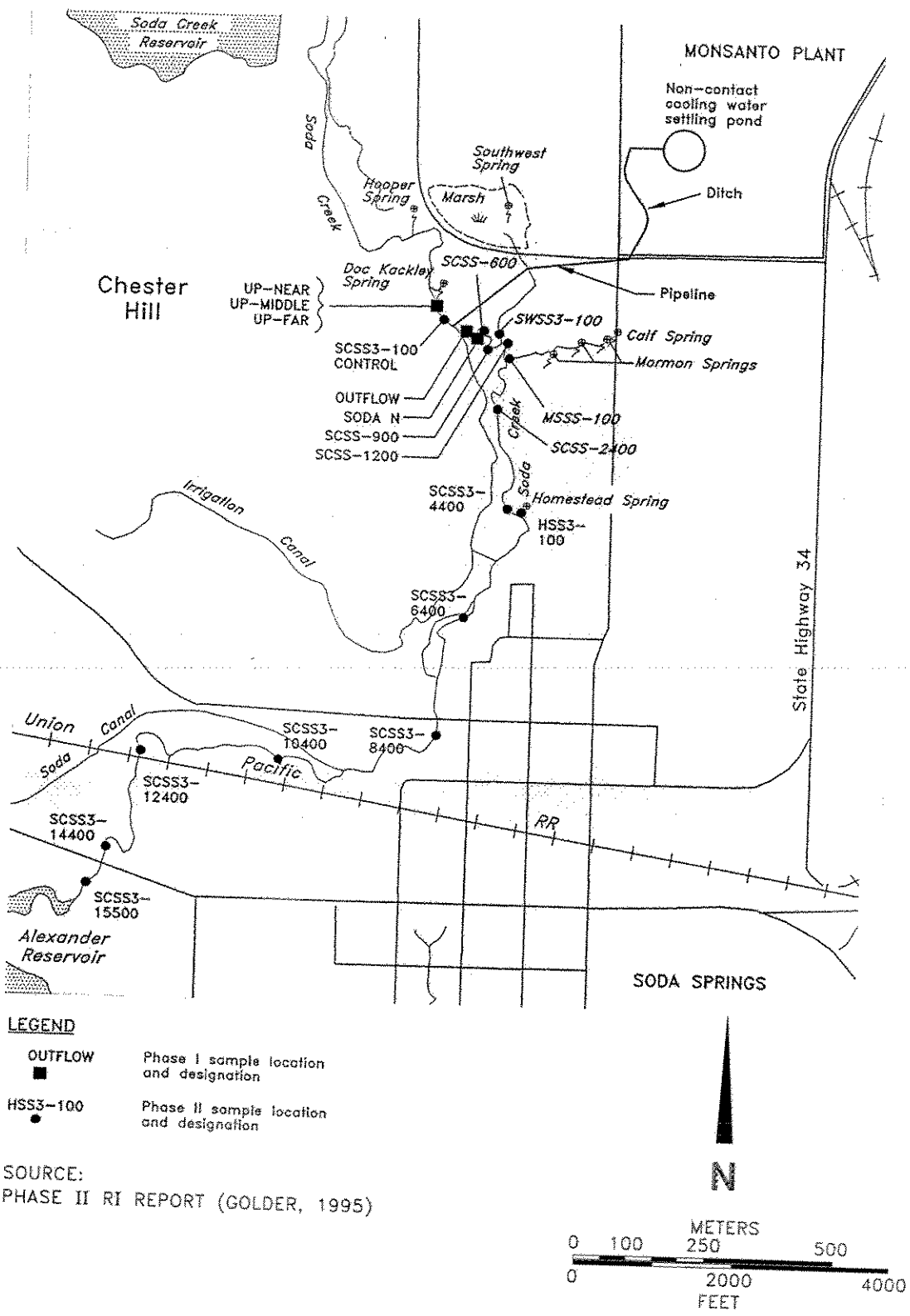
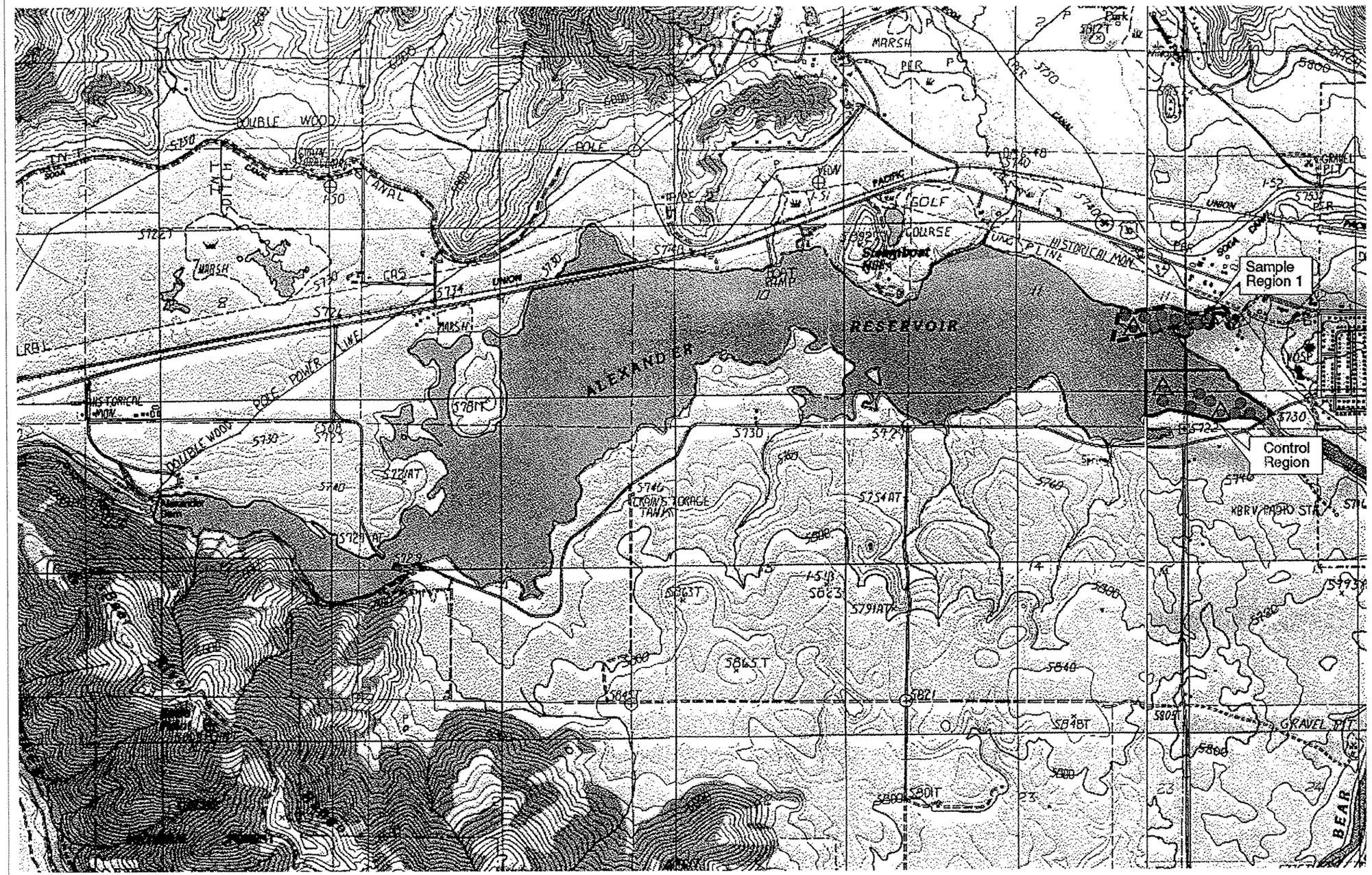


FIGURE 2.1-2

PHASE I AND II SEDIMENT SAMPLE LOCATIONS

MONSANTO/CERCLA FIVE YEAR REVIEW



Explanation

- Sediment Sampling Location
- Sediment Depth Profile and Water Sample

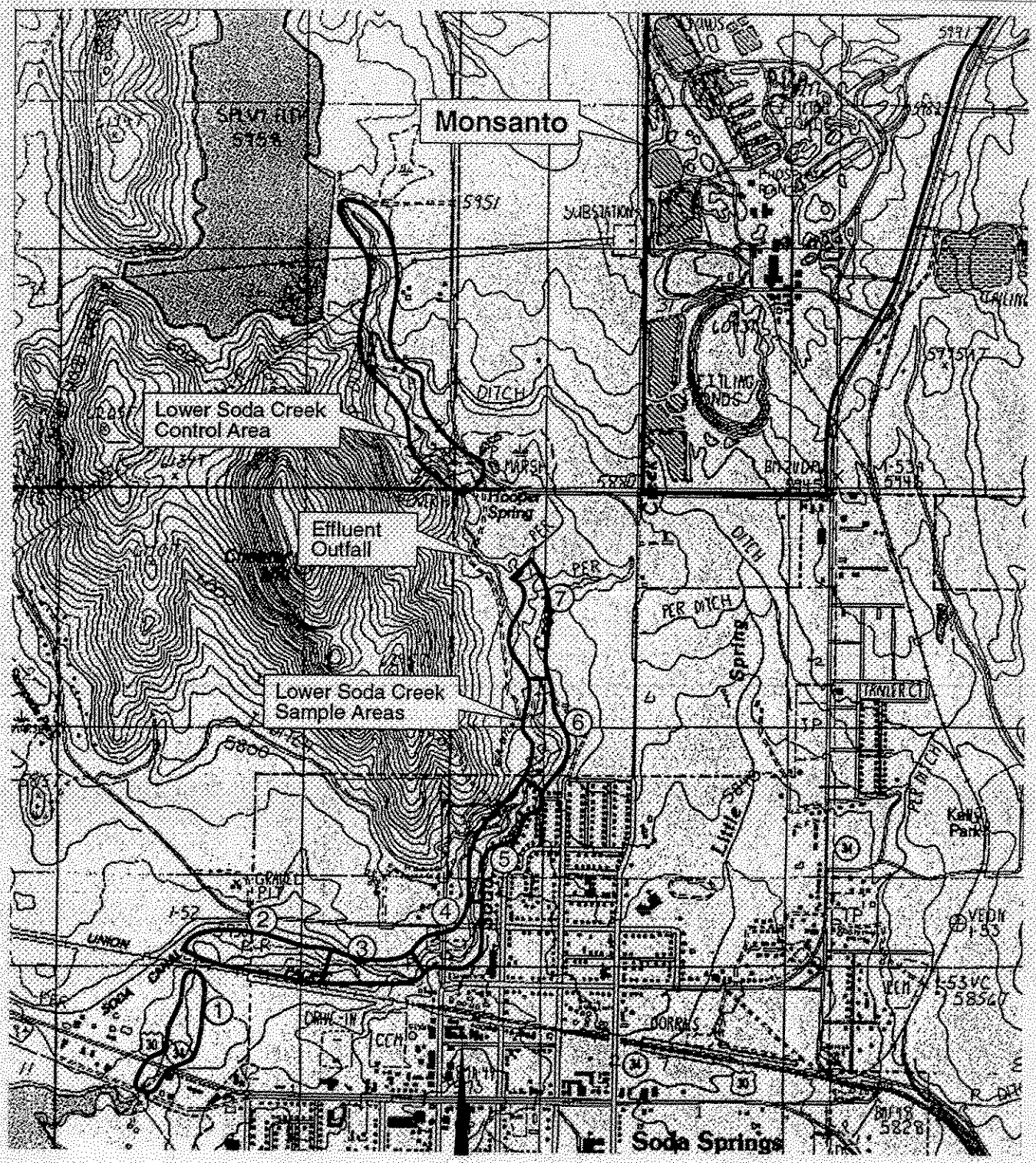
SOURCE:
SAP FOR SODA CREEK AND
ALEXANDER RESERVOIR (GOLDER, 1994)

USGS Topographic Map Soda Springs
Idaho–Wyoming 1:100,000 (1982)

FIGURE 2.1-3

SUPPLEMENTAL SEDIMENT SAMPLE LOCATIONS: ALEXANDER RESERVOIR

MONSANTO/CERCLA FIVE YEAR REVIEW



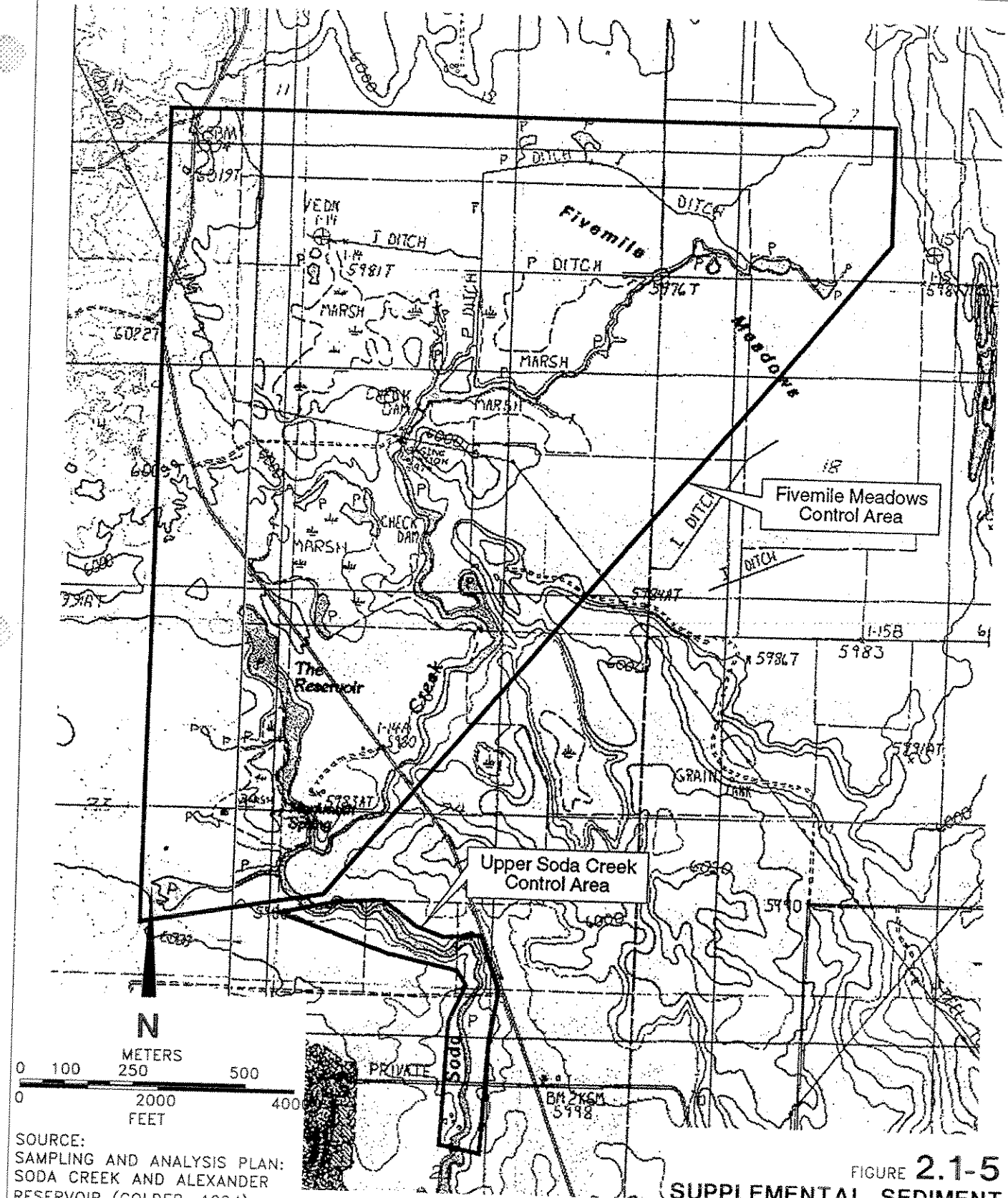
SOURCE:
SAMPLING AND ANALYSIS PLAN: SODA CREEK AND ALEXANDER RESERVOIR (GOLDER, 1994)

USGS Topographic Map Soda Springs Idaho–Wyoming 1:100,000 (1982)

FIGURE 2.1-4

SUPPLEMENTAL SEDIMENT SAMPLE LOCATIONS: LOWER SODA CREEK CONTROL AND SAMPLE AREAS

MONSANTO/CERCLA FIVE YEAR REVIEW



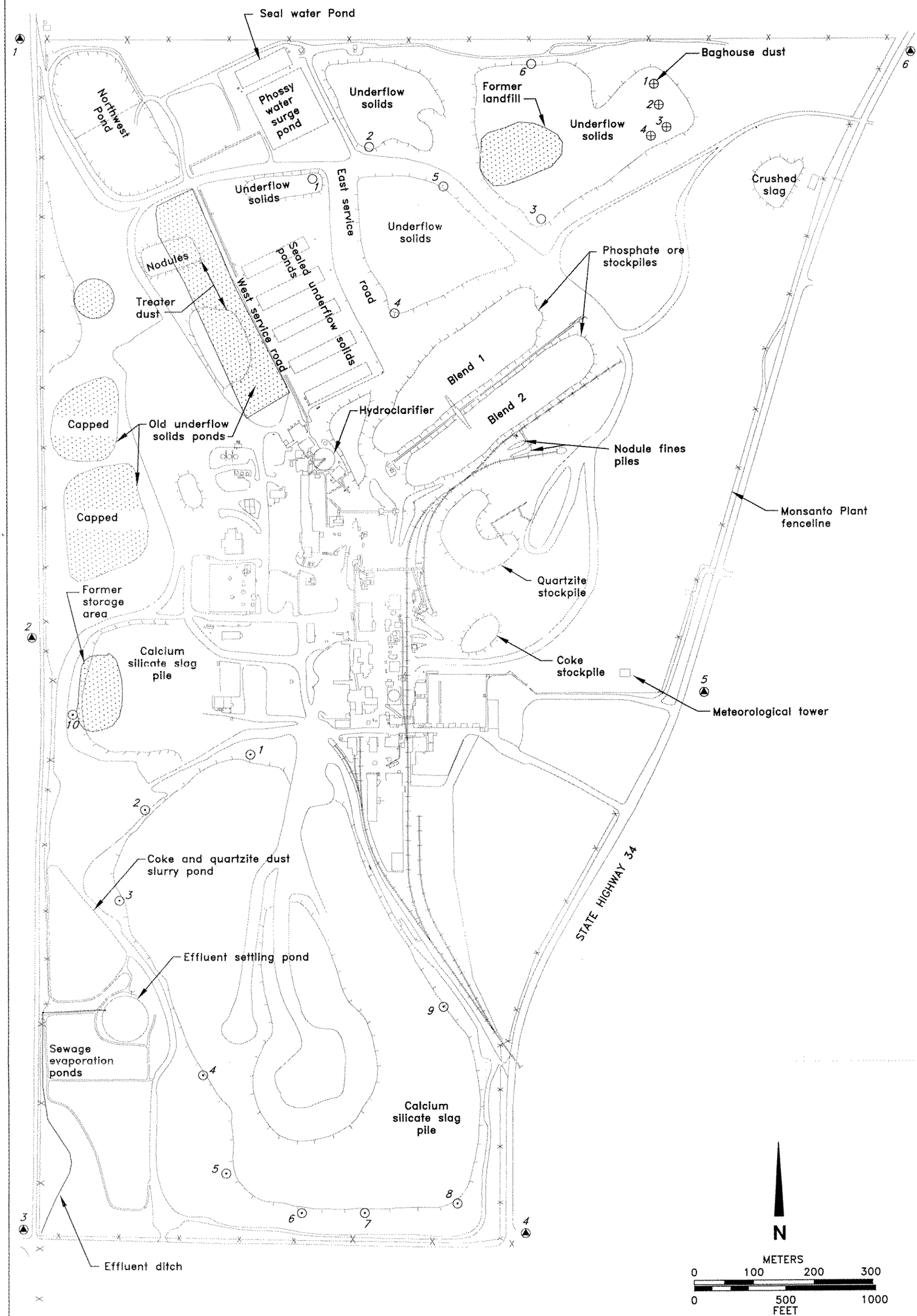
SOURCE:
SAMPLING AND ANALYSIS PLAN: SODA CREEK AND ALEXANDER RESERVOIR (GOLDER, 1994)

USGS Topographic Map Soda Springs Idaho–Wyoming 1:100,000 (1982)

FIGURE 2.1-5

SUPPLEMENTAL SEDIMENT SAMPLE LOCATIONS: FIVEMILE MEADOW AND UPPER SODA CREEK CONTROL SAMPLE AREAS

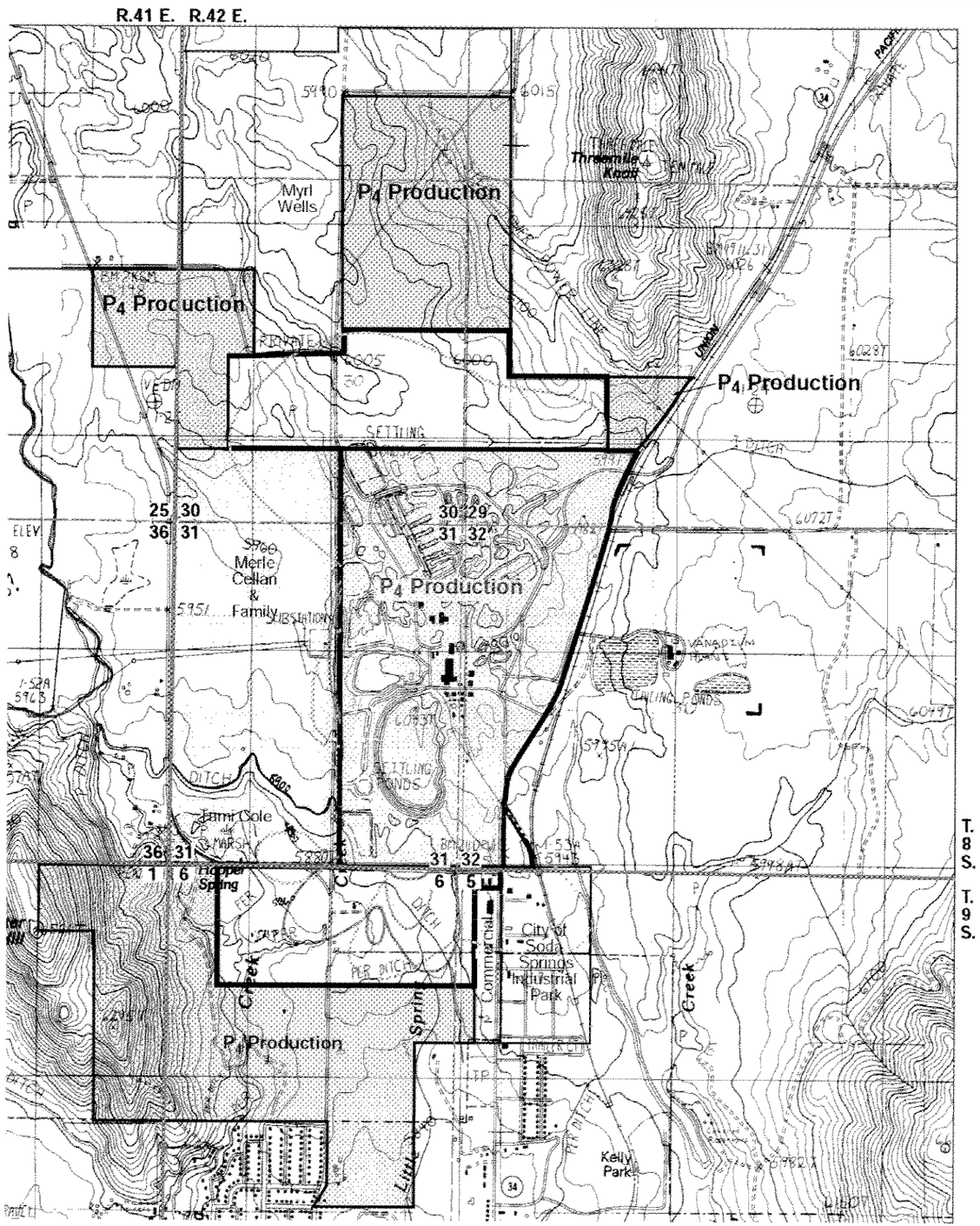
MONSANTO/CERCLA FIVE YEAR REVIEW



SOURCE:
PHASE II RI REPORT (GOLDER, 1995)

FIGURE 2.3-1
LOCATIONS OF PLANT MATERIAL AND BY-PRODUCT STOCKPILE LOCATIONS
MONSANTO/CERCLA FIVE YEAR REVIEW

MWH



USGS Topographic Map Soda Springs Idaho–Wyoming 1:100,000 (1982)

EXPLANATION

- Monsanto Plant Boundary
- Unimpacted P_4 Production lands
- Restrictive covenant
- P_4 Production lands under deed restriction
- Impacted area without restrictive covenant or deed restriction

31 | 32
6 | 5 Section, Township and Range

Soil

Area where Radium-226 concentrations exceed the $3x10^{-4}$ target cleanup level of 3.7 pCi/g

Area boundary is inferred due to inadequate bounding data or uncertainty of constituent(s) source(s)

The areas shown are based on analytical data from soil samples collected from the 0–1" depth interval.

Groundwater Area Potentially Affected above MCLs

- Fluoride 4.0 (mg/l)
- Cadmium 0.005 (mg/l)
- Selenium 0.05 (mg/l)
- Nitrate 44.0 (mg/l)

N

0 2000
Scale in Feet

Source: Soda Springs, Idaho Provisional Edition 1982, and Monsanto, Phase II RI Report (Golder, 1995).

FIGURE **2.7-1**
MONSANTO PROPERTY AND EASEMENT ACQUISITIONS
MONSANTO/CERCLA FIVE YEAR REVIEW

Sep 17, 2002 - 3:10pm Monsanto/Cercla/Figures/2.7-1.dwg

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3. WORK PLAN RATIONALE

3.1 Data Quality Objective Process

This work plan approach is based on the Monsanto Plant characterization as documented in the *Phase II Remedial Investigation Report* (Golder, 1995a) and the *Evaluation of Sediment Chemistry, Toxicity, and Benthic Invertebrate Community Structure in Soda Creek and Alexander Reservoir* (Golder, 1995b), as well as the data needs of the CERCLA five-year review as identified in the ROD. The work plan is developed in general accordance with EPA's data quality objectives (DQO) development process. The DQO process is a seven step process used to determine the type, quantity, and quality of data needed to reach defensible decisions. (*Guidance for the DQO Process*, EPA QA/G4, EPA, August 2000).

3.1.1 Step 1: Stating the Problem

The first step is accomplished in Section 1 of this Work Plan where a conceptual model of the environmental problem is presented and the project team is identified (see Figure 1.1-3, Contractor Organization). Section 2 of this Work Plan presents the background of previous site investigations and summarizes the available data. The end user of the data to be gathered is Monsanto and EPA-10, for use in reviewing whether the remedy identified in the ROD remains protective of human health and the environment. The schedule for performing the work is presented in Section 5 of this Work Plan.

3.1.2 Step 2 – Identify the Decision

In this step, the principal study question is identified and alternative actions are presented. The principal decision for the five-year review is whether or not the selected remedy continues to remain protective of human health and the environment. To reach a determination, several auxiliary questions must be addressed: 1) whether or not constituent concentrations in sediments have increased, decreased or remained stable; 2) whether or not the concentrations of COCs in off-site soils have increased, decreased or remained stable; 3) whether controls at the source piles have been effective in keeping further contaminants from migrating off-site, and 4) whether institutional controls have been put in place to control the land use of all affected soils outside of the plant boundary.

In the case of the first question, any alternative action would require further characterization and source investigation. The alternative actions for the second question would involve specifying further sampling locations to fully characterize the extent if the concentration of COCs has increased, or continuing with the five-year sampling program. The answer to the second question determines the answer to the third question. If contaminants are migrating off-site in and settling in soils in greater concentrations than those previously measured, new source control measures and monitoring programs to ensure their implementation will be required. In the case of the fourth question, the decision depends on whether the characterization of "affected soils" remains

the same after the soil sampling is conducted. The alternative actions would be to do nothing, to complete acquisition of any affected properties in previously unaffected soils, or to institute clean-up of the contaminated soils. All decisions are to be taken by EPA-10 in cooperation with Monsanto.

3.1.3 Step 3 – Identify Inputs to the Decision

Any decisions regarding sediments and soils will be based on the results of the sample analysis from statistically valid sampling locations. Section 4 details the constituents to be analyzed for sediment and soil samples. The Sampling and Analysis Plan (SAP) details the detection limit criteria for data. The control of the source piles will be determined in part by a review of the fugitive dust control procedures and in part by the results of measuring the concentration of constituents in soils. The assessment of Institutional Controls is a desk-based activity reviewing the legal status of parcel acquisitions as compared to the area of affected soils.

3.1.4 Step 4 – Define the Boundaries of the Study

Sediment samples will be collected from Soda Creek and Alexander Reservoir from all of the sampling locations shown on Figures 3.1-1, 3.1-2, 3.1-3. Soil samples will be collected at depths of 0-1 inches at all of the sampling locations shown on Figure 3.1-4 and all of the background locations shown on Figure 3.1-5. All samples will be collected prior to the end of October 2002 to avoid incidences of frost, which could increase the difficulty level of collecting samples.

3.1.5 Step 5 – Develop a Decision Rule

This Work Plan is performed pursuant to the five-year review requirements of the ROD, and any decisions to be made based on the results of sediment and soil sampling will be determined cooperatively by Monsanto and EPA-10.

3.1.6 Step 6 – Specify Tolerable Limits on Decision Errors

The parameters of direct interest in the 5-year review are:

- Soil outside the plant fence line—concentrations of ^{226}Ra within the upper 1-inch stratum at those stations sampled during the RI.

- Sediment in Soda Creek and Alexander Reservoir—concentrations of As, Cd, Cu, Ni, Se, Ag, V, and ^{210}Po within the surface stratum at those stations sampled during the supplement to the RI.

- Materials stockpiles within the plant (most specifically, due to quantities and small grain sizes, underflow solids and treater dust)—cover material substantially intact to minimize fugitive dust generation.

- Groundwater beneath and downgradient of the plant—concentrations of Cd, F, Se, and NO_3 at those wells installed or sampled during the RI that are designated as points of compliance in the ROD.[6]

The null hypotheses for purposes of monitoring each medium are:

- Soil—no increase in concentration.
- Sediment—no increase in concentrations.
- Materials stockpiles—cover material is properly maintained.
- Groundwater—no increase in concentrations.

The soil, sediment, and groundwater hypotheses will be tested directly by sampling each medium. The stockpiles hypothesis will be tested by means of an audit of operations and maintenance procedures. The sediment and soil sampling will also serve as an indirect test of the effectiveness of the stockpiles cover.

Decision errors are, to a large degree, controlled by the ROD, which specifies, directly or implicitly, the frequency and number of samples in each medium. Given that the RI is being duplicated in large extent during monitoring, decision errors for monitoring are expected to be as comparable and as acceptable as those associated with remedy selection in the ROD.

3.1.7 Step 7 - Optimize the Design for Obtaining Data

The SAP documents the sample design and the data quality as measured by precision, accuracy, representativeness, completeness, and comparability (PARCC).

3.2 Work Plan Approach

This five-year review is designed to ensure that the selected remedy remains protective of human health and the environment. This Work Plan is designed to review and document actions taken to date in response to the RAOs for plant and off-site soils, and to test whether those actions have been effective through soil sampling and analysis; as well as to test whether constituent concentrations in sediments are increasing, decreasing, or remaining the same. The sample sites for soils have been chosen based on the results of previous sampling conducted pursuant to the RI Phase I and Phase II Work Plans (Golder, 1991, 1992). The sample sites for sediments have been chosen based on the results of previous sampling conducted pursuant to the *Sampling and*

[6] Although groundwater monitoring is being conducted by Golder Associates, the results of the groundwater monitoring will appear in the Five-Year Report published pursuant to the results of this Work Plan, so it is accounted for in this section of the DQOs.

Analysis Plan for the Collection and Analysis of Sediment and Water Samples from Soda Creek and Alexander Reservoir (Golder, 1994).

3.2.1 Soda Creek and Alexander Reservoir Sediment Investigation

The results of the Phase I and II RI sediment sampling downstream of the effluent outfall showed elevated levels of arsenic, cadmium, copper, nickel, selenium, silver, vanadium, and ^{210}Po. Extensive toxicity testing was conducted via supplemental sampling in Soda Creek and Alexander Reservoir in addition to the RI testing, but no correlation was ever established between elevated site-related contaminants and toxicity. *The supplemental sediment sampling will be repeated in order to assess whether the concentration levels have changed. All constituents showing an elevated concentration in either the RI or supplemental sampling will be analytes of interest.*

3.2.2 Pedological Investigation

The soil sampling conducted in Phase I was focused around the Plant fence line, and provided definition of constituents found in soils immediately adjacent to the Plant, however, this study did not fully characterize the vertical or lateral extent of constituents in soils that may be attributable to Plant operations. Additional definition of the areal extent of the constituents attributable to the Plant in soils surrounding the Plant was performed in Phase II through further surface and subsurface soil sampling around the Plant perimeter. It was found that many of the COPCs were clustered outside the northern and southern boundaries of the Plant, and that radionuclides were concentrated in the surficial soil (0-1 inch depth). In general, the maximum concentrations of COPCs are found along the Plant fenceline and concentrations decrease with increasing distance from the Plant. No constituent in soil profile samples collected 6-24 inches beneath the surface exceeded any screening criteria. *Soil profile samples for the CERCLA five-year review will be collected from all of the Phase I and II sampling locations at the 0-1 inch depth interval to evaluate constituent concentrations of ^{226}Ra. Twenty control soil samples will be collected at background locations selected during Phase II.*

3.2.3 Source Investigation

Based on the results of the Phase II RI, the majority of the material and byproduct stockpiles were determined to be sources of constituent releases of trace metals and radionuclides affecting off-site soils. A dust suppression control plan was subsequently put into place. *In addition to collection of soil and sediment samples at designated off-site locations to determine the effectiveness of the source controls, the implementation of the dust suppression controls will be assessed through a review of records, interviews with key personnel, and observation. Figure 2.3-1 is a facility map showing the 1992 locations of the material and byproduct stockpiles. The figure will be updated to reflect the current footprints of the stockpiles based on recent aerial photographs and ground measurements.*

3.2.4 Institutional Controls

Figure 2.7-1 shows the present-day boundaries of Monsanto property and easement acquisition. All properties with impacted soils have been purchased or easements acquired. *Once the results of the soil sampling has been analyzed and the extent of contamination has been re-characterized, land acquisition status will be reviewed to ensure that it remains protective of human health and the environment.*

3.2.5 Summary of Data Needs

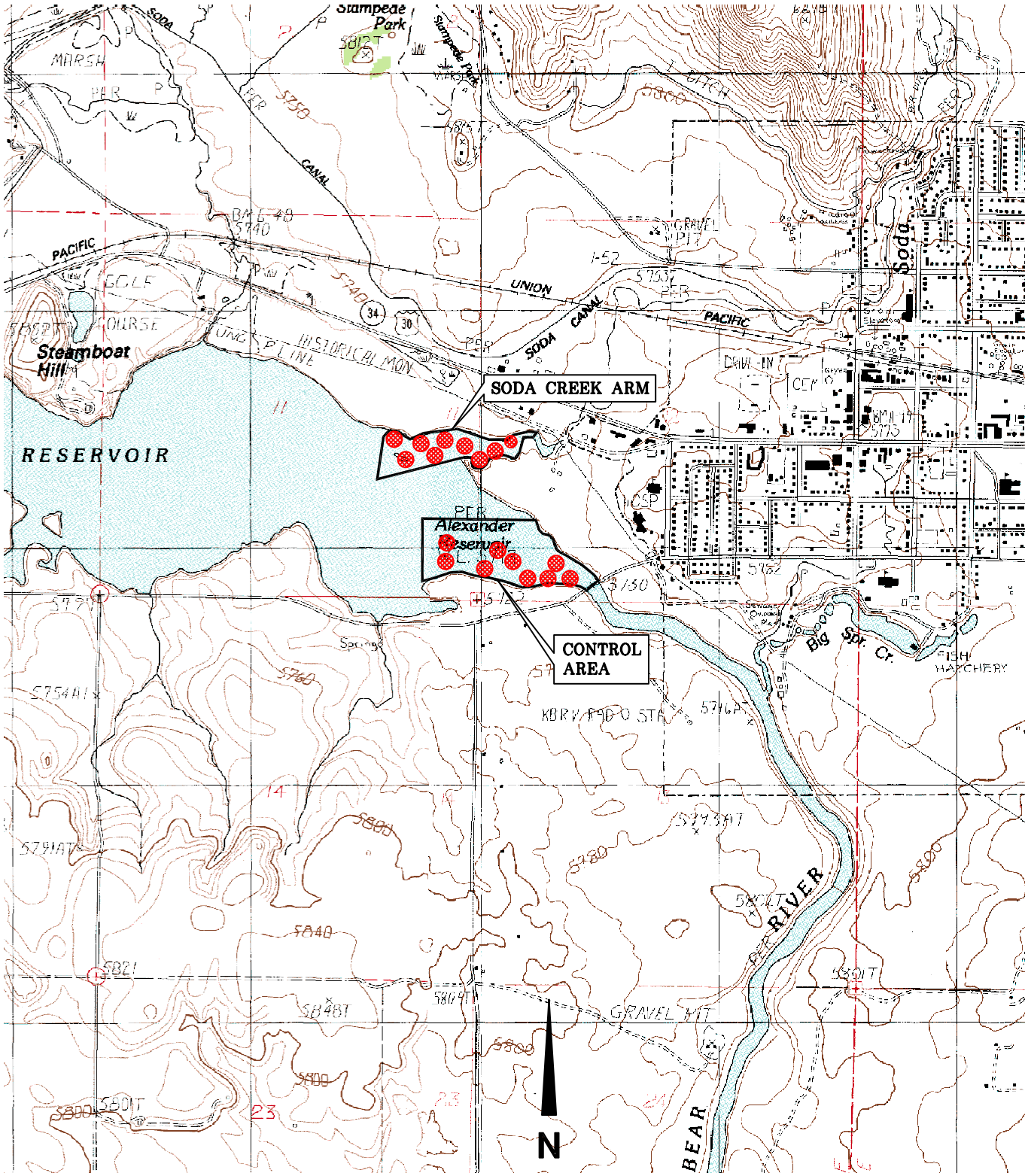
Based on the preceding Sections, the five-year review will involve the following integrated data collection tasks:

- Sediment investigation
- Pedological investigation
- Assessment of source controls on stockpiles and update of stockpile map
- Assessment of Institutional Controls

If additional site characterization data is indicated during implementation, this Work Plan shall be modified accordingly.

3.2.6 Data Evaluation Methodologies

Data from the sediment and pedological investigations will be evaluated as soon as it is validated and available. Statistical comparisons with both background conditions and conditions found during previous sampling will be performed to determine which constituents are present in elevated concentrations. Statistical analyses will be carried out to identify temporal trends in constituent concentrations.



Explanation

Sediment Sampling Location

SOURCE:
SAP FOR SODA CREEK AND ALEXANDER RESERVOIR (GOLDER, 1994)

USGS Topographic Maps: Soda Springs Idaho 1:24,000 (1982), Alexander Idaho 1:24,000 (1982)

METERS
0 100 250 500
0 2000 4000
FEET

Figure 3.1-1

ALEXANDER RESERVOIR SAMPLE LOCATIONS

MONSANTO/CERCLA FIVE YEAR REVIEW

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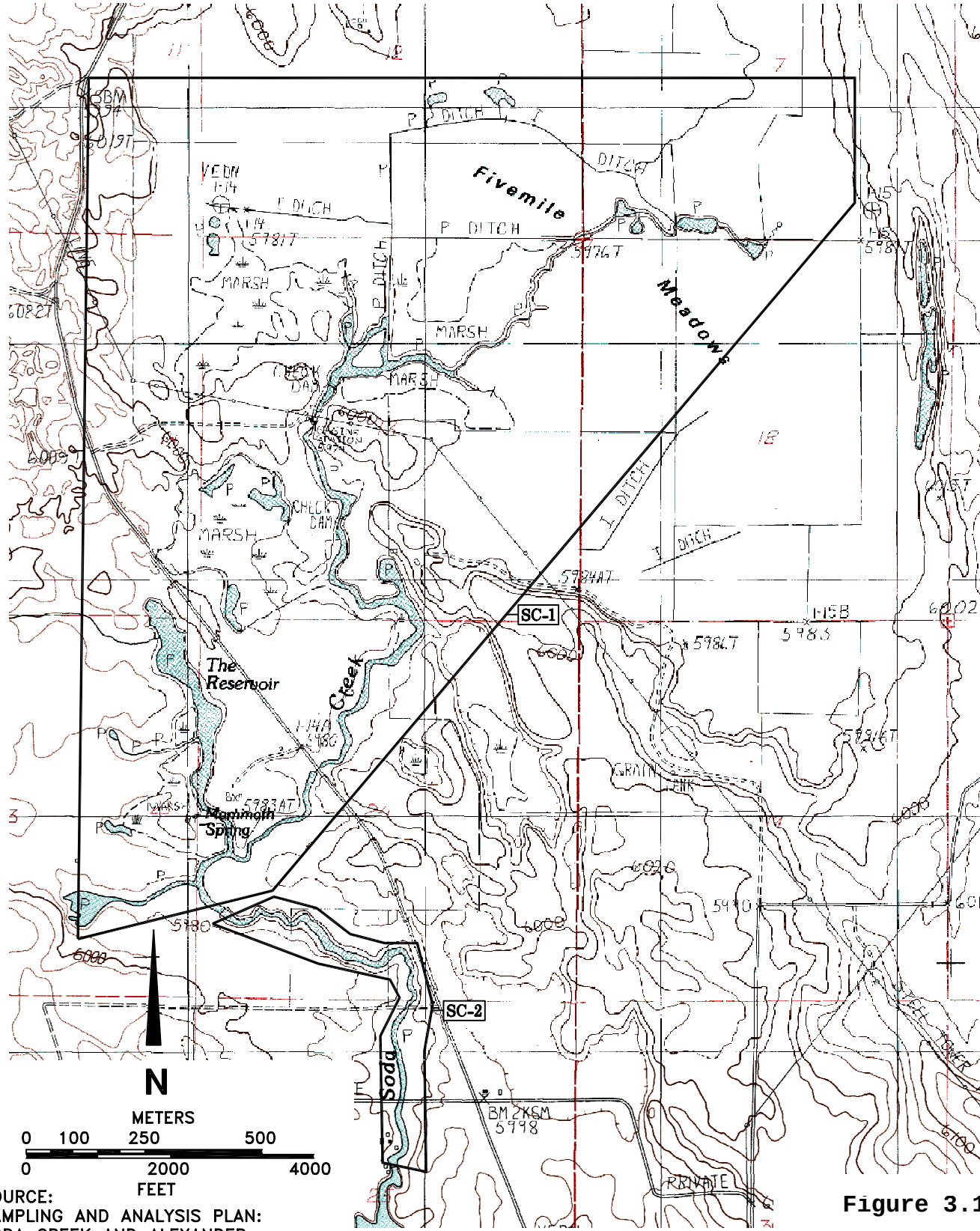


SOURCE:
SAMPLING AND ANALYSIS PLAN: SODA CREEK AND ALEXANDER RESERVOIR (GOLDER, 1994)

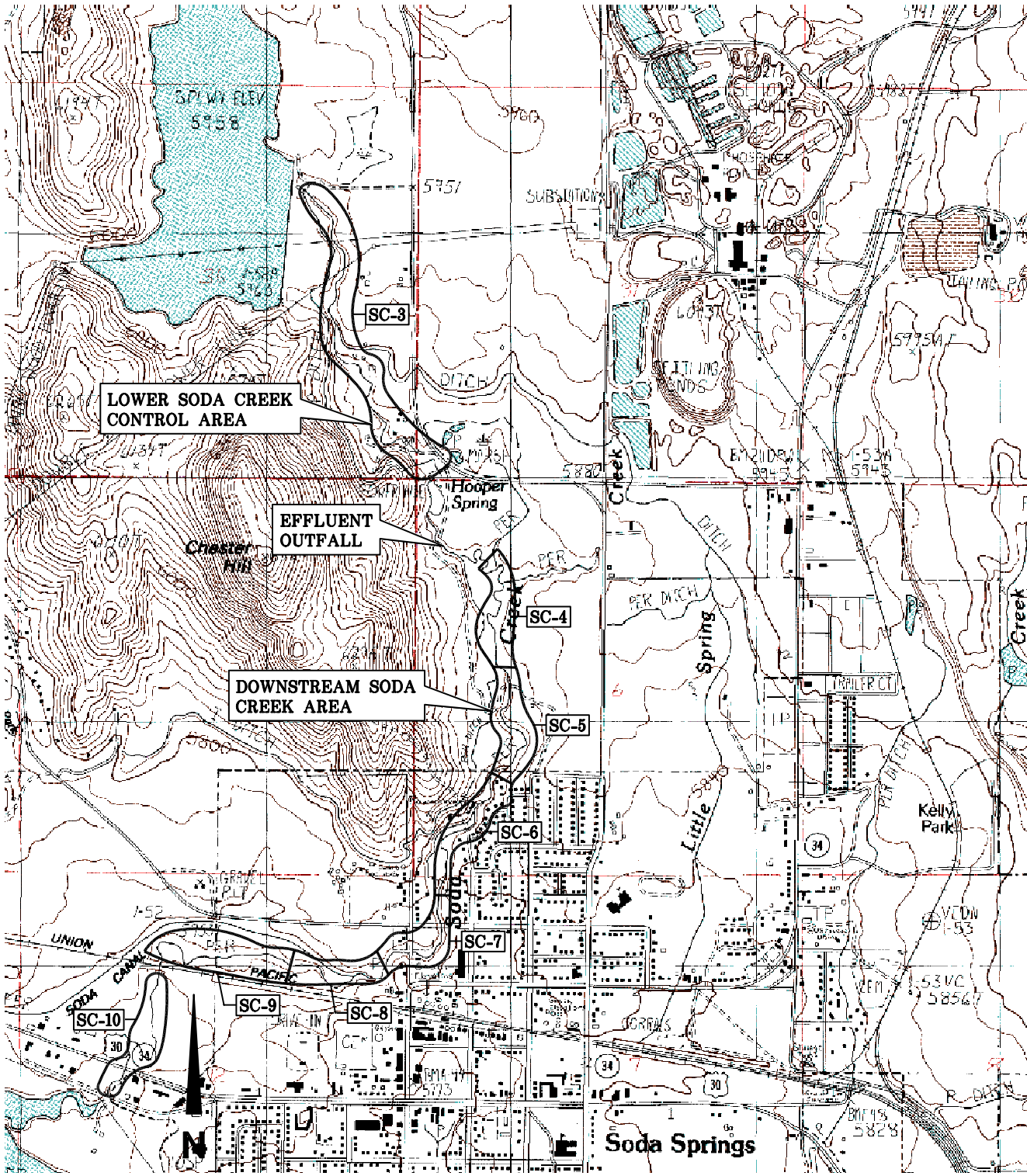
USGS Topographic Maps: Soda Springs Idaho 1:24,000 (1982), Alexander Idaho 1:24,000 (1982)

Figure 3.1-2

FIVE-YEAR REVIEW SEDIMENT SAMPLING LOCATIONS: MIDDLE AND UPPER SODA CREEK CONTROL AREAS

MONSANTO/CERCLA FIVE YEAR REVIEW

MWH



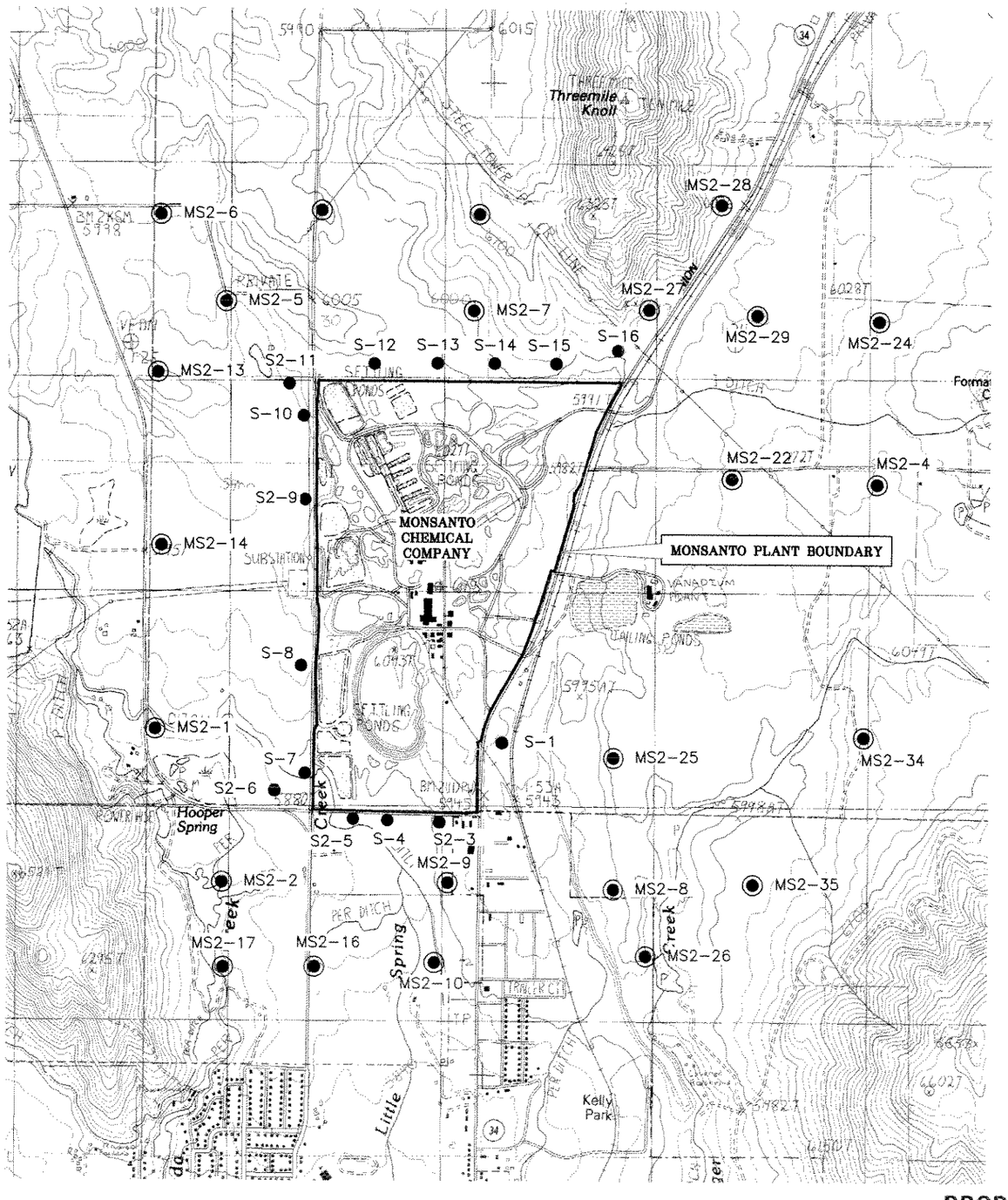
SOURCE:
SAMPLING AND ANALYSIS PLAN: SODA CREEK AND ALEXANDER RESERVOIR (GOLDER, 1994)
USGS Topographic Maps: Soda Springs Idaho 1:24,000 (1982)

Figure 3.1-3

FIVE-YEAR REVIEW SEDIMENT SAMPLING LOCATIONS: LOWER SODA CREEK CONTROL AND DOWNSTREAM AREAS

MONSANTO/CERCLA FIVE YEAR REVIEW

MWH



LEGEND:

- ● S-XX —— SOIL SAMPLING LOCATION FROM PHASE I
- ◉ MS2-XX — SOIL SAMPLING LOCATION FROM PHASE II

N

METERS
0 100 250 500
0 2000 4000
FEET

SOURCE:
PHASE II RI REPORT (GOLDER, 1995)
USGS Topographic Map Soda Springs Idaho-Wyoming 1:100,000 (1982)

FIGURE **3.1-4**
PROPOSED FIVE-YEAR REVIEW SOIL SAMPLING LOCATIONS
MONSANTO/CERCLA FIVE YEAR REVIEW

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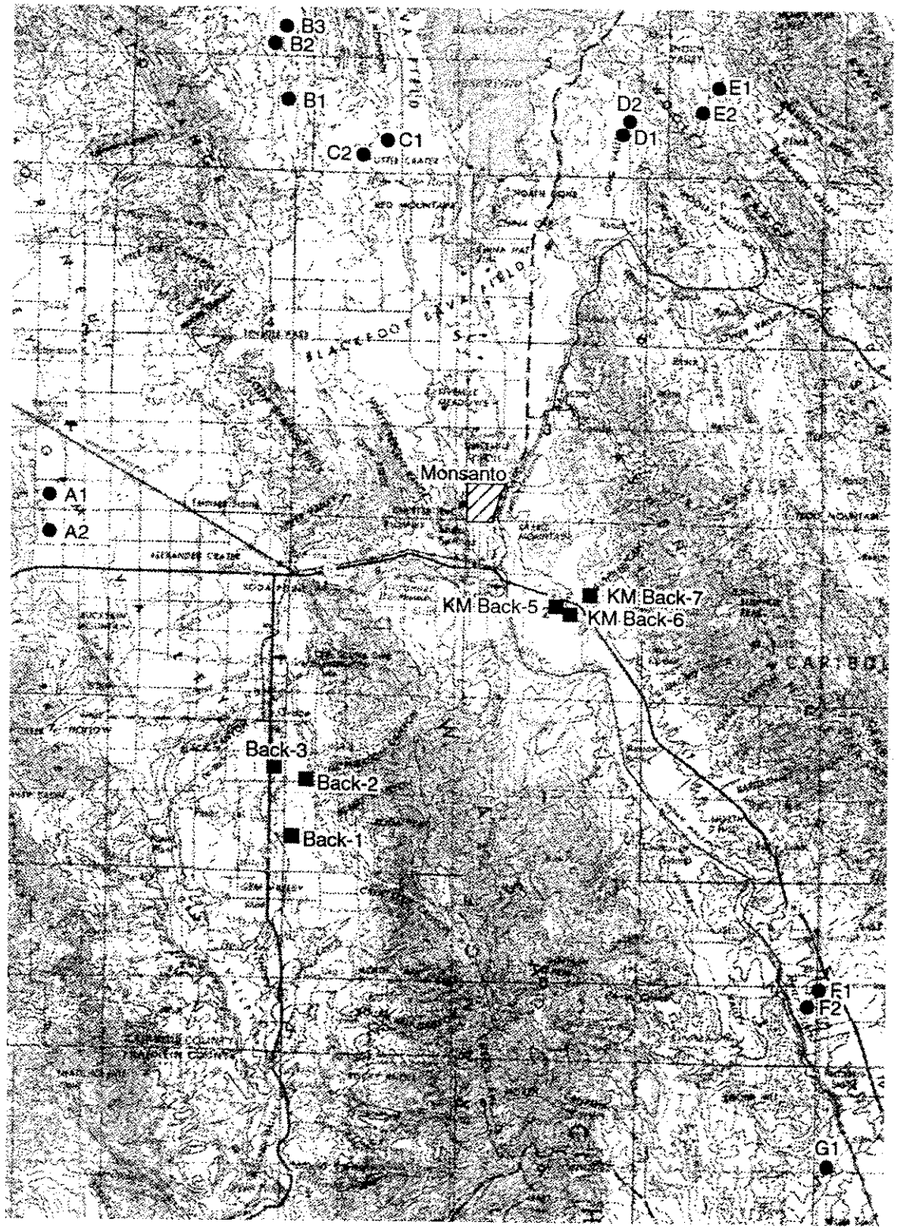

SOURCE:
PHASE II RI REPORT (GOLDER, 1995)

USGS Topographic Map Soda Springs
Idaho–Wyoming 1:100,000 (1982)

FIGURE **3.1-5**
PROPOSED FIVE-YEAR REVIEW
BACKGROUND SOIL SAMPLING LOCATIONS
MONSANTO/CERCLA FIVE YEAR REVIEW

Sep 17, 2002 - 4:43pm Monsanto/Cercla/Figures/3.1-5.dwg

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4. FIVE-YEAR REVIEW TASKS

4.1 Task 1: Sediment Investigation

Task Objective: The overall goal of this task is to determine whether or not the concentration of metals downstream of the effluent outfall has increased, remained stable or decreased since the last sampling was conducted.

Task Description: Sediment samples will be collected from the shallow creek using a stainless steel trowel. All in-stream sediment sampling will progress in a downstream to upstream direction to avoid sample contamination. Sediment samples will be collected from the Alexander Reservoir and depositional zones in Soda Creek using a petite Ponar dredge for the reservoir, and a grab method for the creek.

Sample Location and Analysis:

- **Alexander Reservoir:** Two areas of Alexander Reservoir will be sampled: one control region and one sample region. The area closest to the Bear River Inlet, south of the main river channel, will serve as the control. The area closest to the inlet of Soda Creek will be the sample area. Nine sample locations within each area have been selected based on the locations sampled in 1994.

- **Soda Creek:** Soda Creek has been divided into ten reaches to reflect similar sediment deposition characteristics. Reach boundaries have been approved by EPA-10 during previous sampling. Three reaches located upstream of the Monsanto non-contact cooling water outfall were chosen for collection of reference samples. The remaining seven reaches are located downstream of the outfall to the confluence of Soda Creek with Alexander Reservoir.

Proposed sediment sampling locations for Alexander Reservoir, lower Soda Creek and upper Soda Creek are shown, respectively, in Figures 3.1-1, 3.1-2, 3.1-3. The sediment samples will be analyzed for the following constituents: As, Cd, Cu, Ni, Se, Ag, V, and ^{210}Po. Detection limits and analytical methods are discussed in detail in the SAP.

4.2 Task 2: Soils Investigation

Task Objective: The overall goal of this task is to determine whether or not the concentration level of radionuclides and trace metals in off-site soils has increased, remained stable, or decreased since the last sampling was conducted. The results will also determine whether or not the controls on source materials are adequate to prevent further air dispersion of contaminants.

Task Description: Soil samples will be collected from 39 locations between the plant fenceline and approximately one mile from the perimeter (all of the Phase I and Phase II sampling locations with the exception of those located inside the Plant fenceline), at a depth interval of 0-1 inches. Background samples will be collected from 20 locations (previously sampled during

Phase II) at a depth interval of 0-1 inches, the interval used to calculate upper tolerance limits during the Phase II sampling. Samples will be collected using a stainless-steel scoop. All soil sample collection will be in accordance with procedures presented in the SAP.

Sample Location and Analyses: Soil sample locations will be established at least 50 feet from secondary roads and 100 feet from primary highways. Soil sampling locations are shown on Figure 3.1-4. Figure 3.1-5 shows the locations of the background sampling locations. Soil samples will be analyzed for ^{226}Ra. It should be noted that the 0-1 inch interval best represents the soils available for wind-borne transport.

4.3 Task 3: Source Control Assessment

Figure 4.3-1 is a current aerial photograph depicting the locations and extent of the material and by-product stockpiles. Figure 2.3-1 is a map of the plant from 1992 detailing the material and by-product stockpiles. The actual locations and extent of the source stockpiles will be reviewed and Figure 2.3-1 will be updated to accurately reflect the current size and locations of stockpiles.

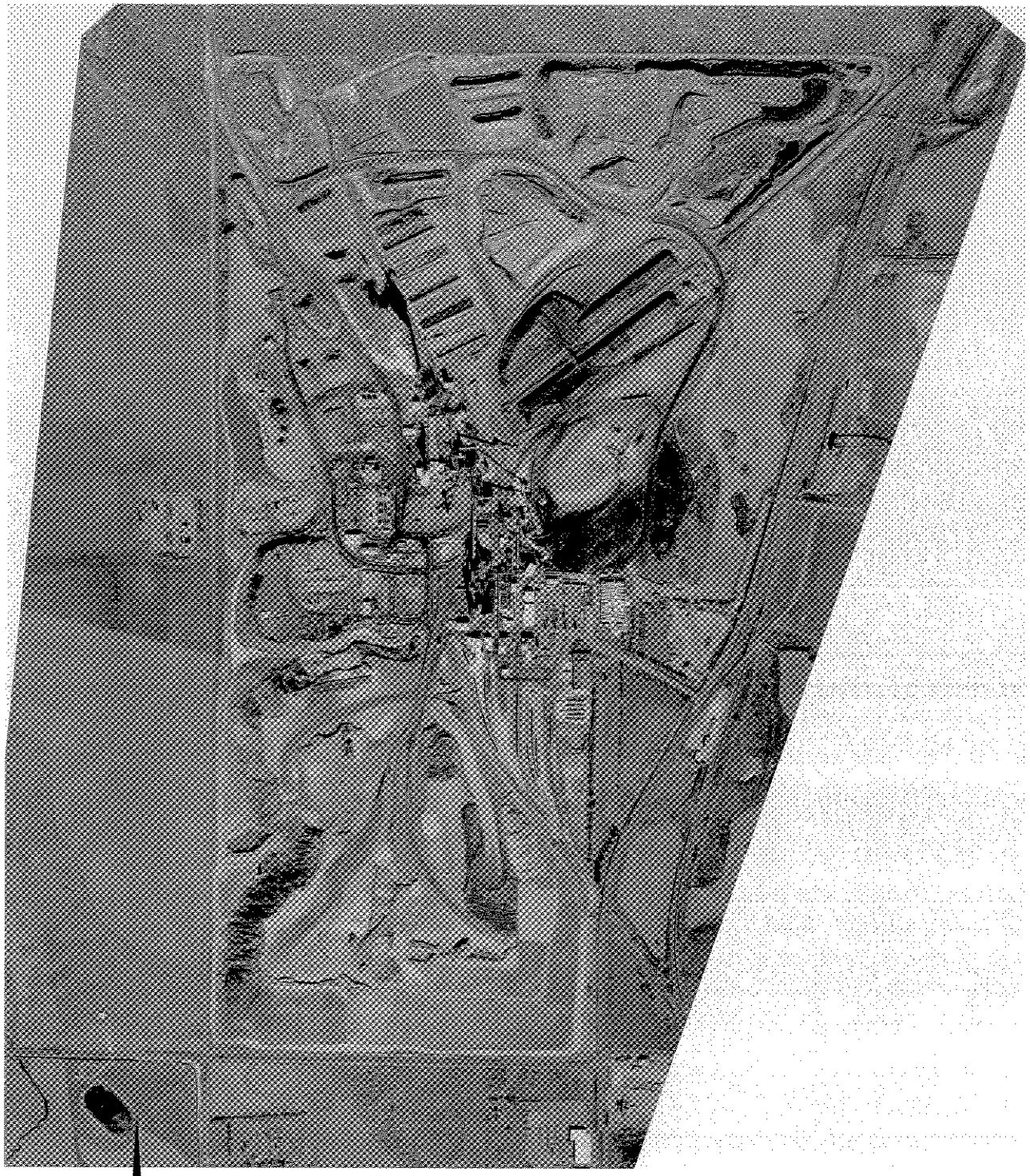
Following the completion of the soil sampling and analysis, an assessment will be made of whether source controls have been effective in preventing increased off-site constituent migration.

4.4 Task 4: Institutional Control Assessment

Following the conclusion of soil sampling and analysis, if the concentration of COCs has been shown to increase, the status of Institutional Controls and land use will be re-assessed.

4.5 Schedule

Figure 4.5-1 shows the proposed schedule for the CERCLA five year review. This schedule is contingent upon approval of the Work Plan and accompanying SAP by EPA-10.



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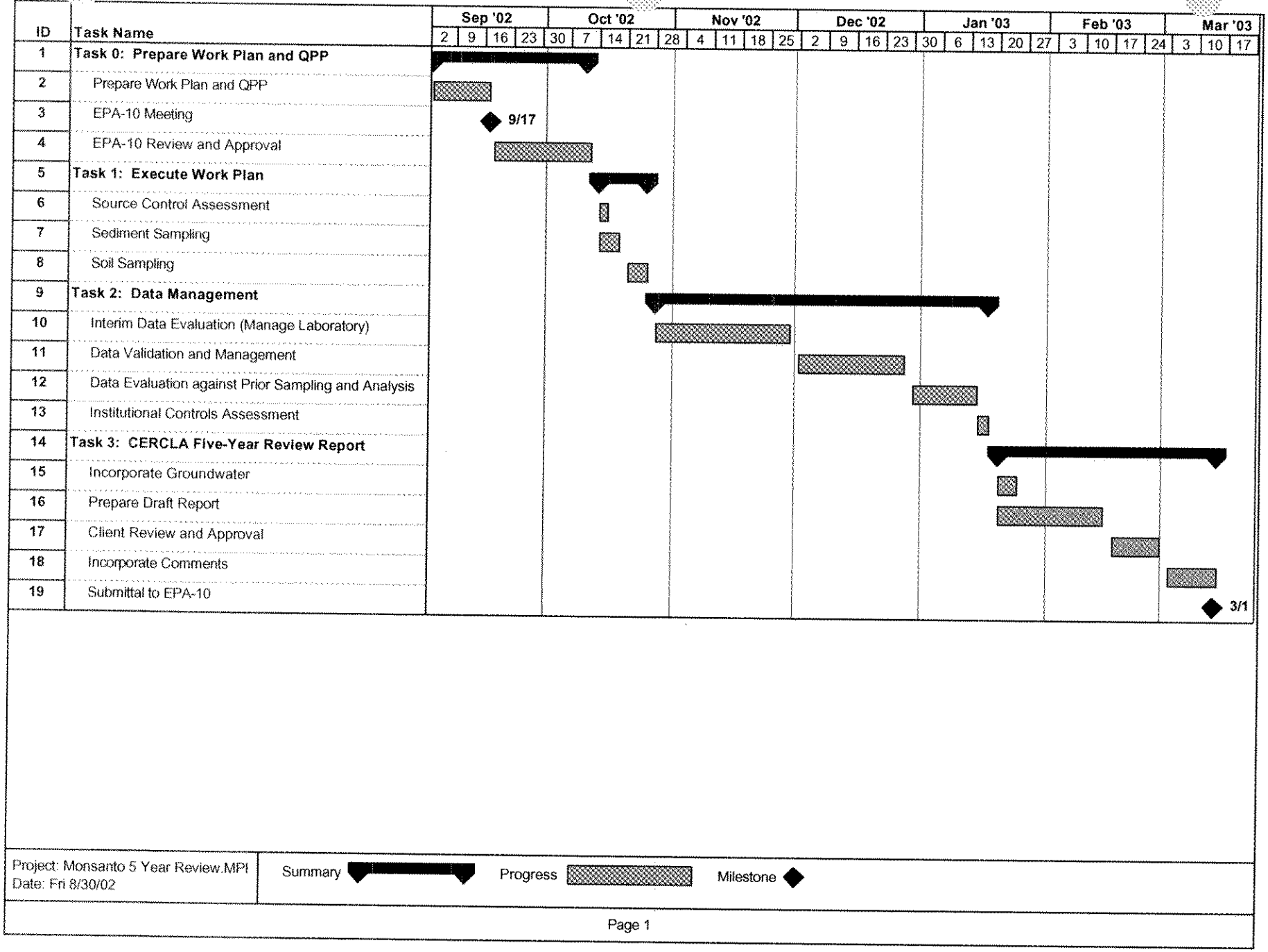
METERS
0 50 150 250
0 1000 2000
FEET

FIGURE **4.3-1**
AERIAL MAP OF MONSANTO PLANT 2002
MONSANTO/CERCLA FIVE YEAR REVIEW FIELD SAMPLING PLAN



Project: Monsanto 5 Year Review.MPI
Date: Fri 8/30/02

Summary Progress Milestone

5. REFERENCES

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